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INDEX

TO

ENGINEERING NEWS

FOR THE YEARS

1900 TO 1904 INCLUSIVE

COMPILED BY

MARY E. MILLER

Graduate Pratt Institute Library School, Librarian Equitable
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INTRODUCTION.

With the vast increase in the volume of engineering literature that has taken place in the past quarter century has come the necessity for its systematic indexing. On the one hand engineers are more than ever dependent on the published literature of their profession for data on which to base their work in design, construction, and administration—the days when the individual engineer could afford the time to accumulate general data in his own notebook are past. On the other hand, the difficulty of finding information on a particular subject has greatly increased, with the increased bulk of existing literature.

It has long been the aim of the editors of Engineering News, in selecting matter for publication, to consider first of all the direct practical usefulness of the matter to the working engineer. As a result, it is safe to say that a greater proportion of the total issue of Engineering News is bound and permanently preserved for reference than is the case with any other American engineering journal. To make the information in these volumes conveniently accessible, however, there is needed, besides the semi-annual indexes to the separate volumes, a general index which will enable the engineer to find at once all the matter published on a particular subject during a series of years.

The present publication, indexing the ten volumes of Engineering News issued from January 1, 1900, to January 1, 1905, is the third such general index to this journal which has been issued. The first one covered the 16 years from the foundation of the journal in 1874 to the end of 1890. The second, a much larger and more systematically compiled volume, covered the years from 1890 to 1899, inclusive; and the present, as just stated, covers the matter published in the five years following.

As a slight indication of the growth of the engineering profession and the corresponding growth of Engineering News, it may be here noted that the first general index, covering the 16 years preceding 1890, was a volume of 118 pages; the second book, covering the decade preceding 1900, contained 324 pages, and the present volume, covering only half a decade, contains 291 pages. In part, however, the increase in size is due to more careful and complete indexing; and users of the present volume will, we are sure, find it an improvement over its predecessor issued five years ago.

HOW TO USE THE INDEX.

It sometimes happens that the searcher after information will take up the index and turn at once to the subject he desires to find; but quite as often it happens that he will have to look in several places before finding the particular heading under which the indexer has placed it; and oftentimes a persevering search is necessary to find it. For instance, some two years ago there was published an account of the partial failure of a reinforced concrete building at Corning, N. Y. Suppose someone desires to refer to this article, and looks for it under the various headings, "Accidents," "Corning," "Concrete," "Reinforced concrete," "Concrete steel."

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He will find it under none of these headings, but will find it under "Buildings: Failures." On the other hand, suppose the searcher does not know of this particular article, but is merely looking for general information on reinforced concrete. If he looks only at the references under that specific head, he will have only a very small part of the information on that subject which has been published in this journal during the past five years. Under "Buildings," "Dams," "Bridges," "Floors," and numerous other heads will be found information quite as valuable as that under the particular heading of "Reinforced concrete."

Because many engineers are inexperienced in the use of indexes, we have thought it worth while to print here the following suggestions which may be of aid to the searcher after information, either in the present index or in any engineering index compiled with intelligence and systematic method.

1. Form a definite, concrete idea of what it is desired to find.
2. Form an opinion as to the most probable heading or headings under which the indexer has entered the desired information, and write these headings down. Then look in the index for the most probable heading, afterward for the next probable, and so on, paying due heed to cross-references.
3. Look usually for a noun, and seldom for an adjective; for example, articles on difficult shaft-sinking are indexed under "Shaft-sinking," and not under "Difficult."
4. Look for a general rather than a specific name; for example, look for articles on the Brooklyn Bridge under "Bridges," not under "Brooklyn"; articles on the Chicago Main Drainage Channel under "Canals" or "Sewers," not under "Chicago," or "Drainage"; articles on Hall signals are under "Signals and signaling," not under "Hall," or "Banjo," or "Disk." But the common name taken as a key-word should be a specific technical name, rather than the name which a layman might use.
5. If the desired items are not found under the headings that seem unquestionably appropriate, it is likely either that special reasons led the indexer to use grouping and group-indexing for the topic, or else that the item or items sought for had as their main subject something other than the topic in which the searcher is interested.
6. Questions as to the classification or grouping which may conceal items on a given topic may often be resolved, when no assistance is obtained from alternative reference or cross-reference, by looking up a related topic which is more important, and therefore more likely to have separate entry or more likely to be revealed in cross-references. Thus, when no entry is found under "Contact beds," and no more likely heading occurs to the searcher, he may obtain assistance by looking under "Filters," where is given the cross-reference "(See also Feed-water filters; Sewage purification; Water purification)," indicating that all items relating to sewage treatment (hence also contact beds) are grouped under the heading "Sewage purification."
7. The case where the topic in which the searcher is interested does not form one of the leading subjects of the corresponding items and articles, so that this topic cannot yield suitable key-words for the search, is very

frequent. It is then necessary to refer to all topics whose individual items may contain something on the subject in question, and often it is necessary to locate, look up, and read a great mass of items and articles, in order to sift out the bits of information concerning the particular topic in hand. This cannot be avoided, it is inherent in bibliographic research, and can in no wise be charged against the index.

8. The case where a topic upon which search is made is concerned in several entry-headings besides the main or natural one is also of frequent occurrence. Thus, if research be made on the subject of Retaining-wall theory, it is not sufficient to look only under the heading "Retaining-walls," but a number of other actual or possible headings should be referred to, as "Embankments," "Earthwork," "Grain elevators," "Bins," etc. Intelligence and perseverance are essential for success in such cases. Cross-references have been liberally used to aid the searcher; but it is impossible, of course, to insert cross-references on every possible heading that might be thought of.

9. There are some few cases of parallel, closely related subjects, which yet must all be used in the index. The subjects, "Streets," "Roads," "Pavements," are a good example of this. Much of what a searcher under any one of these heads would require to find would probably be entered under one or the other of the remaining headings. The distinction made by the indexer is not necessarily the same as that made by the searcher. Again, an article relating quite specifically to "Pavements," and therefore properly entered under that heading, may in part be applicable to roads, and may be as important to the searcher for information on "Roads" as many of the articles entered under the latter heading.

10. It sometimes happens that a searcher wishes to find a particular article written by a certain engineer. In such a case the quickest plan is to refer to the separate "Author Index," placed at the end of the volume, which is a new feature not included in any of our previous general indexes.

11. The matter contained in the weekly "Construction News Supplement" is not included in the present index, with the exception that from the beginning of 1903 to the middle of 1904 certain editorials and letters of especial interest to contractors were printed here instead of in the body of the paper. These articles are indexed in this book; but in referring to them it should be borne in mind that the Construction News Supplement is paged separately from the rest of the paper.

12. The monthly "Engineering Literature Supplement" which has formed a part of Engineering News for the past three years is only partially indexed in the present volume. This Supplement was also separately paged up to July 1, 1904, since which date the pages have been numbered in with the other reading matter pages.

In conclusion a word may be permissible, particularly to the younger generation of engineers, on the value of Engineering News as a work of reference, and the importance of preserving and binding the issues for this purpose. Read the paper, week by week, as much as time and opportunity permit, to keep yourself abreast of current progress and events in

the profession. Used in this way, the paper has a large educational value. But in these busy days it often happens that an engineer will find little or no time to keep up with professional literature. The time that he needs it most is when a practical problem confronts him and he wishes to know what others have done under similar conditions; and what data exist that will enable him to work intelligently and with a safe reliance on past precedent. Under such circumstances, Engineering News is the engineer's indispensable tool, and the present volume is designed to be a labor-saving aid in its use.

THE EDITORS OF ENGINEERING NEWS.

220 Broadway, New York, November, 1905.



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 Cast iron, Interlocked. Solid bridge floor, A. L. Weymer, designer. 1901, i-*160.
 "1900, ii—112" means "Year, 1900, second volume, page 112."

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Concrete:

- Cuba. San Juan River bridge, Santiago to Caney. By E. J. Chibas, 1903, i-*549.
- Discussion of concrete and Melan arches. 1902, i-98.
- Ehingen, over the Danube River. Three-hinged arched bridge. 1902, i-*35.
- Golden Gate, Yellowstone Park, bridge. Effect of clay and loam on cement mortar. By C. E. Sherman, 1903, ii-*443.
- High arch at Danville, Ill. 1902, i-241, 440.
- Low-level bridge over Mary River, Maryborough, Queensland. By A. B. Brady, 1901, i-*126.
- Mechanicsville, N. Y. Three-arch bridge. 1903, ii-*408.
- Miltenberg, Germany, over the River Main. Three-hinged arch highway bridge. 1901, ii-†61.
- Oviedo, Spain, over the River Nalon. 1901, ii-*215.
- Pebble-faced bridge, National Park, Wash., D. C. By W. J. Douglas, 1903, i-*70.
- St. Louis & San Francisco Ry. bridges. 1904, ii-387.
- San Leandro, Cal., Eighty-foot arch bridge. 1903, ii-*174.
- Substructure and superstructure. Ohio law concerning highway bridges. 1900, ii-183, 248.

Concrete, Reinforced:

- Aurora, Elgin & Chicago Electric Ry. bridge and cattle-passes. 1902, ii-*283, *285.
- Boulder-faced concrete bridge over Rock Creek, National Park, Wash., D. C. By W. J. Douglas, 1902, ii-*109.
- Brooklyn. Seeley St. bridge carried over Prospect Ave. Concrete with bar and stirrup reinforcement. 1903, ii-*588.
- Chattellerault bridge over River Vienne, France. 1902, i-*290.
- Cheap highway bridge near Wabash, Ind. By D. B. Luten, 1902, ii-*114.
- Cost of bridges on L. S. & M. S. Ry. 1904, ii-*36.
- Design of. By D. B. Luten, 1902, i-370, *377, 522; By E. J. McCaustland, 1904, i-373; By W. J. Douglas, 1904, ii-37.
- Different systems of construction. 1903, i-77.
- Flattest arch in the world. By B. L. Green, D. B. Luten, 1902, ii-362, 402.
- Grand Rapids, Mich., bridge, Structural details of. By W. F. Tubesing, 1904, ii-*489.
- Illinois Central Ry. bridges and culverts. Concrete specifications. 1901, ii-†43.
- Illinois Central Ry., over Big Muddy River. Bridge of three concrete arches. By H. W. Parkhurst, 1903, ii-*423.
- Jordan Narrows on Rio Grande Western Ry., in Utah, Arches in. By W. P. Hardesty, 1903, i-*495.
- Laibach, Austria. Three-hinged arch bridge. 1903, ii-*61.
- Melan system. (See below, Melan system.)
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- Plainwell, Mich., highway bridge. By P. A. Courtright, 1904, i-*456, 543.
- Plano, Ill. C., B. & Q. Ry. bridge over Big Rick Creek. 1904, ii-*559.
- Porto Rico. Bridges over Jacaguas and Guayo Rivers. By Edward Thacher, 1901, ii-*66.
- Ransome system at Franklin St. bridge, Bangor, Me. 1902, i-*222.
- St. Louis, Mo., in Forest Park. Concrete arch bridge reinforced by corrugated square bars. 1903, i-*530.
- Surface finish of concrete culverts, N. Y. C. & H. R. R. R. By G. W. Lee, 1903, i-*246.
- Surface finish of Philadelphia bridges. By H. M. Quimby, 1904, i-108.

* denotes an illustrated article. † denotes an inset sheet.

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Flat arch bridges, Elliptical and circular. By B. L. Green, D. B. Luten, 1902, ii-362, 402.

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Ehingen, over Danube River. Three-hinged concrete arch bridge. 1902, i-*35.

Laibach, Austria. Three-hinged concrete steel arch bridge. 1903, ii-*61.

Long-span, three-hinged masonry arch over River Isar, Germany. 1902, ii-*224.

Menominee River, C. & St. P. Ry. Three-hinged steel arch. 1902, ii-*418.

Miltenberg, Germany. Three-hinged concrete arch highway bridge over the River Main. 1901, ii-†61.

Spain, River Nalon, near Oviedo. Three-hinged concrete arch of 165-ft. span. 1901, ii-*215.

Viaur, France. 721-ft. three-hinged steel arch railway bridge. Skew-back and center hinges. 1900, ii-†158; By René Bonnin, 1903, ii-*216.

Wurtemberg, River Neckar. Highway bridge of concrete. 1900, i-*202.

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Masonry:

Design of arch bridges. By A. W. Buel, 1902, i-*362; 1902, ii-34.

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Formula for crown thickness. Details of many arches. By D. B. Luten, C. Mogamy, Emile Low, William Cain, 1904, ii-43, 243, 365, 405, 448, 487.

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Melan system:

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Indianapolis, Ind. Bridges over Fall Creek. 1901, i-*258.

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Pittsburg, Pa., Nine-Mile Run. Steel plate girder bridge. By Willis Whited, 1903, i-*186.

Rio Grande River, Pacific Ry., Costa Rica. 1902, ii-†326.

Viaur, France. 721-ft. three-hinged steel arch railway bridge. 1900, ii-†158.

White Pass & Yukon Ry. bridge, near Skagway, Alaska. Strain sheet and tables. 1901, i-*218.

"1900, ii-112" means "Year, 1900, second volume, page 112."

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Zambesi River. 500-ft. arch bridge. 1904, ii-*253.

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Bellows Falls, Vt., Fitchburg R. R. 140-ft. span arch bridge. False-work centers. 1900, i-*402.

Calculating arches. By C. H. Wallace, 1903, i-411.

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Long-span three-hinged arch over River Isar, Germany. 1902, ii-*224.

Luxemburg bridge. Construction of the centers. 1901, ii-267; 1902, i-†179, *193, 254; 1903, i-*206.

Masonry bridge compared with iron or steel bridges. 1901, ii-216.

Morbegno, Italy, River Adda. Large arch. 1903, ii-256.

Neustadt & Donaueschingen Ry., Germany. Long-span arch. 1901, ii-*487.

Notes on the Luxemburg bridge, Florence bridges and notable railway viaducts. Stresses in masonry and concrete arches. By A. W.

Buel, L. J. Johnson, Carl Gayler, D. B. Luten, 1902, i-*362, 483.

Penn. R. R. bridges. 1900, i-*310; 1901, ii-*448; 1902, i-*86; 1903, i-*538.

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Stillwater Creek, Morristown, Ohio. Erected in 1826. 1901, i-*367.

Watertown, Wis. Chic., Mil. & St. P. Ry. bridge. 1903, i-*266.

Stresses in masonry and concrete arches. Notes on various bridges. By L. J. Johnson, Carl Gayler, D. B. Luten, A. W. Buel, 1902, i-*362, 483.

Stresses in three-hinged arches, Graphical method for. By J. W. Balet, 1904, ii-356.

Tie rods, Value of. Tests of small model cement arches. By D. B. Luten, 1900, i-*106, 112.

Wrought-iron arch viaduct at Paderno, Northern Italy. 1903, i-*545.
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Tarsney act. 1901, ii-262.

Architect's Plaint; verses. By F. M. Small, 1903, i-432.

Architectural competitions, Code for the conduct of. 1901, ii-87.

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Developments in ordnance and armor equipments in attacking armor with high-explosive shell. By J. F. Meigs, E. B. Babbitt, 1901, ii-385, 388, 398.

Development of modern ordnance and armor in the United States. By Rear-Admiral Charles O'Neil, 1902, ii-451, 485.

Plate-hardening process invented by Lieut. Davis. 1902, ii-89.

Prices. Contracts let to Carnegie and Bethlehem companies. "Letting contracts without competition." 1900, ii-101, 321, 354, 358.

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* denotes an illustrated article. † denotes an inset sheet.

Army, U. S.:

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Probity of army engineers and their small compensation. Case of Capt. King at Mobile, Ala. 1901, i-64.

Robert, Col. Henry M., Promotion of, to Chief of Engineers. 1901, i-305.

Arnold, Bion J., Biographical sketch of. 1904, i-†91.

Artesian wells. (See Wells.)

Asbestos:

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Production of, in 1902. By J. H. Pratt, 1903, ii-338.

Ash handling plants:

Boston Elevated Ry., Charleston River Station. Novel method. 1902, i-469.

Chic. & N. W. Ry., at Clinton, Iowa. 1901, i-*114.

Phil. & Read. Ry., at Philadelphia. 1901, ii-*102.

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Ash wagon, Gasoline motor, New York. 1902, i-151.

Ashes, Disposal of:

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New York City. Notes on bids and contracts. 1901, ii-297.

San Francisco, Cal. By F. J. Mills, 1900, i-318, 325.

Asphalt:

Facts relating to the asphalt industry. Foundation and mixture. Pitch Lake of Trinidad. Refining and mixing asphalt. Other asphalt deposits. By P. W. Henry, 1901, i-182.

Production of, in U. S., for 11 years. 1903, ii-193.

United States, Asphalt and bituminous rock deposits in. From report by G. H. Eldridge. 1902, i-452.

Venezuela, War over ownership and control of asphalt deposits in. 1900, ii-442.

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Association of Cleansing Superintendents of Great Britain, Notes on report of. 1900, i-272.

Association of Engineering Societies, Record of prosperity of. 1900, i-176.

Association of Railway Superintendents of Bridges and Buildings, Conventions. 1900, ii-268, 287; 1901, ii-284; 1902, ii-354, 358; 1903, ii-396; 1904, ii-377.

Association of Railway Telegraph Superintendents, Convention. 1902, i-518.

Atlanta, Ga. Engineering and allied features of the proposed charter. By Emmet Steece, 1902, ii-61, 64, 97.

Atomizer for introducing moisture in furnace-heated houses. By W. E. Saunders, 1904, i-*63.

Australia, Industrial legislation in. 1904, ii-362.

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Axles:

Carbon percentage and car axles. 1900, i-428.

Chemical composition of steel car axles. Report at Master Car Builders' Association. 1901, ii-7.

Lubricating driving and truck axles. 1901, i-472.

Manufacture and properties of hollow pressed steel axles. Homestead works of Carnegie Steel Co. By Zoltán Oberschall, Camille Mercader, 1903, i-*412, 453.

Roller bearings for car axles, London, Brighton & South Coast Ry. 1904, ii-598.

Specifications for locomotive axles and forgings. 1903, ii-20.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Axles: (Continued.)

Steel axles, Manufacture and specifications. By J. L. Replogle, 1904, i-471.
 Unit pressure on locomotive axle bearings, according to American and Russian practice. 1902, ii-25.

Azimuth:

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 Use of true azimuths for the direction of land boundaries in the Hawaiian Islands. 1903, ii-519.

B.

Babcock & Wilcox Co. Property right in trade name. 1901, ii-330.

Backwater from dams, Effect of, on meadow lands. By E. G. Harris, W. D. Taylor, G. E. Ladshaw, 1902, ii-192, *316.

Bacteria:

Book by George Newman. 1900, i-120.

Effect of a snowfall on bacteria in the air. 1904, ii-598.

Killing bacteria in water or milk by hydrostatic pressure. Tests at West Virginia Agricultural Experiment Station. By F. H. Stillman, 1900, ii-230, *236.

Street dust analyses in Lafayette, Ind., and in New York. By D. B. Luten and Severance Burrage, 1900, ii-*242; 1902, ii-429.

(See also Water analyses.)

Bag-conveying system, Walter Baker & Co., Milton, Mass. 1902, i-*78.

Baker, M. N., Editorial correspondence of. 1904, i-347, 385, 394, 442, 525, 533, 572, 622.

Baldwin Locomotive Works:

Labor system and management of works. By J. W. Converse, 1903, i-31.
 Seventieth Anniversary. 1902, i-172.

Ball bearings:

Ball-bearing standards for large sluice and gate valves. Coffin Valve Co. 1902, i-390.

Friction of ball bearings, Tests of. By M. J. Golden, 1903, i-129.

Street car motors, Ball bearings for. 1903, ii-304.

Tests of ball step bearings at Case School, Cleveland, Ohio. By C. H. Benjamin, 1901, i-*403.

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Burned clay, Experience with. Costs. 1901, ii-279.

Gravel. Crushing and cleaning plant of the Chic. & Alton Ry. 1904, i-*164.

Handling, Best methods of. Report at Roadmasters' Association. 1900, ii-341.

Reports at American Railway Engineering and Maintenance of Way Association. 1901, i-200; 1903, i-285; 1904, i-261, 302.

Specifications. Report at American Railway Engineering and Maintenance of Way Association. 1903, i-285.

Standards in the United States, Canada and Mexico. 1900, ii-142.

Stone ballast, its claims to superiority. By E. A. Hermann, 1903, ii-532, 568.

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Ballast curb for railway bridge abutments. 1903, ii-*74.

Ballast loaders, Torrey. 1903, ii-361.

Ballast plant of the Chic. & Alton Ry. 1904, i-*164.

Ballasting:

Ballasting new railways. Economy to ballast with good earth until road-bed becomes settled. 1901, ii-123.

Report of American Railway Engineering and Maintenance of Way Association. 1902, i-234.

Tamping of ties with gravel ballast, broken stone ballast and sand ballast. 1901, ii-279.

* denotes an illustrated article. † denotes an inset sheet.

Ballasting: (Continued.)

Track laid with steel longitudinals. 1904, i-*407.

Baltimore, Rebuilding plans for. Need of municipal program. By D. J. Hauer, 1904, i-153, 511, 516.

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Bank protection. (See Retaining walls; Slope protection; Slope walls.)

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Base line measurements for the 98th meridian triangulation, use of iced bars. By J. F. Hayford, 1902, ii-*162, 168.

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Calculating continuous and constrained beams, Simple method of. By Edward Godfrey, 1902, i-316.

Diagram for calculating size of beams for various locations and intensities of concentrated loads. By E. P. Goodrich, 1901, i-377; E. R. Maurer, E. P. Goodrich, 1901, ii-26.

Diagram for computing flat roof beams. By J. A. Ray, J. P. Brooks, 1902, i-52, 113.

Diagram for computing wooden stringers. By P. E. Stevens, 1904, ii-10.

Eccentric loading, Strength of beams under. By A. T. Nickerson, Jr., 1903, i-547.

Formulas for strength of I-beams. By R. D. Johnson, R. W. Carter and Luther Twichell, 1900, ii-389, 445.

Guy's experiments on the flexure of beams. By F. A. Halsey, 1903, ii-Eng. Lit. Sup. June 18, July 16.

Longitudinal shear. 1904, ii-113.

Rules for designing beam work. By C. E. Young, 1903, ii-270.

Special sections of 10-in. and 12-in. I-beams for use as girders, proposed by W. F. Scott, 1902, ii-*266.

Statical moment of a cross-section. 1904, ii-199.

Steel beams, rolled by Grey process, in Germany. 1901, ii-*387.

Table for strength of I-beams and channels used as beams. By J. A. Holmboe, 1904, i-107.

Table showing sizes and weights of I-beams to be used for various lengths of span for bridges or culverts, using stone or concrete slabs. 1904, ii-581.

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Bell, Sir Lowthian, President of the Institution of Mining Engineers of Great Britain. 1904, ii-445.

Bench marks, Book of, at Hartford, Conn. 1902, ii-373.

Berlin, Germany, Impressions and observations in. 1904, i-*573.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Bethlehem Steel Co.:

Bonus system of rewarding labor. 1901, ii-460.

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Bingham, Utah:

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Bins:

Cement stock bins of Hudson Portland Cement Co. 1903, ii-*73.

Coal pockets of Lehigh Valley R. R. at Newark, N. J. By W. G. Berg, 1903, i-*304.

Concrete-steel bins for grain elevators. Designed by J. A. Jamieson. Reinforcing columns by hooping. 1904, i-588, *597.

Concrete-steel bins, Monier, for storing Portland cement. Illinois Steel Co. 1902, ii-148, *498.

Design of. Formulas and tables. By R. W. Dull, 1904, ii-62.

Fire in coal storage bins, Grand Mere, P. Q. 1904, i-375.

Grain pressures in deep bins, Tests of. By J. A. Jamieson, H. E. Vautelet, William Cain, 1904, i-224, *236, *403, 451.

Experiments in Montreal. The strength of wooden bins. By H. T. Bovey, 1904, ii-32.

Tests at Buenos Aires, Argentina. By Eckhardt Luftt, 1904, ii-*531.

Large portable bins for crushed stone, Acme. 1903, i-*488.

Ore bins:

Highland Boy mine, Bingham, Utah. By W. P. Hardesty, 1902, ii-*60.

Parabolic suspension, Cleveland Furnace Co. By C. H. Wright, A. S. Berquist, 1904. i-*436, 470, 566.

Storage bin for coal tippie, Virginia & Pittsburg Coal & Coke Co., Fairmont, W. Va. 1901, ii-*195.

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Bit for drilling in earth with steam drills. By C. M. Ayres. 1903, ii-*368.

Bitumens, Testing of, for paving purposes. By A. W. Dow, Clifford Richardson. 1903, ii-59, 72, 123.

Black diamonds of Bahia, Brazil. 1902, ii-159, 169.

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Blast furnace gases, Dust in. By Adolph Greiner, 1901, ii-150.

Blast furnace practice, A decade in American. By F. L. Grammer, 1904, i-229.

Blast furnace slag:

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Utilization of the heat of slag for developing power by the Mitchell-Copeland Power Co. By A. W. Clapp, 1902, i-369, 393.

Blast furnaces:

Charcoal, Bosnia, Germany. 1902, ii-225.

Coal consumption varies with amount of moisture in air. 1900, ii-57.

Construction and equipment of a modern American furnace of the Lorain Steel Co. By A. C. Johnston, 1901, i-†248, 250.

Cooling tuyeres by aspiration of the water. System invented by W. J. Foster. 1902, ii-379.

Dry-air blast at the Isabella furnaces, Etna, Pa. By James Gayley, 1904, ii-399.

* denotes an illustrated article. † denotes an inset sheet.

Blast furnaces: (Continued.)

Electric burner for opening tuyeres. Experience at Cleveland, Ohio. By F. L. Grammer, 1901, ii-346.

Equalizing the temperature of the hot blast, Apparatus for, Middlesborough, Eng. By L. F. Giers and J. H. Harrison, 1902, ii-*268.

Explosions. By J. M. Hartman, 1902, i-37.

Fine ores cause trouble in large furnaces. 1902, i-61.

Flue dust used in small furnace at Sharpsville, Pa., not a success. 1903, i-243.

Linings:

Protection of lining above the mantle. By S. S. Hartranft, 1900, ii-*251.

Stock distribution and its relation to the life of a lining. By David Baker, 1904, i-*294.

Lorain Steel Co. Construction and equipment of a modern furnace. By A. C. Johnston, 1901, i-†248, 250.

Metallurgy of the cupola. By H. E. Field, 1902, ii-46.

Oldest iron furnace west of the Allegheny mountains.. Legends of blast-furnace cremations. 1902, ii-*414, 476.

Process for bringing down hung charges. 1903, i-523.

Report for 1902 and 1903. 1903, ii-193.

Water-cooled blast furnace bosh. By Axel Sahlin, 1901, ii-*212.

West African smelting house. By C. V. Bellamy, 1904, ii-*391.

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Blast-hole loader, Cope & Cornelius. 1904, ii-*234.

Blasting:

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Manila Harbor. Large blast and fatal asphyxiation by the after fumes. 1904, i-*88.

Neutralizing gases of blast in a tunnel. 1904, i-541.

Pike's Peak Power Co. Blowing up of Vesuvius Butte. 1900, i-*314.

Block system of moving railway trains. (See Signals and signaling.)

Blowers:

Blower systems of heating, Condensation of steam in. Results of tests. By R. C. Carpenter, 1900, i-*72.

Centrifugal blower with adjustable discharge. Buffalo Forge Co. 1902, i-*65.

Economy in moving air illustrated by manufacturers' bids. 1901, i-136.

Mining installation. Arrangement of dampers for reversible fan. By L. M. Hall, 1902, ii-*133.

Power required by centrifugal blowers for cupolas and forges. Formulas. By William Sangster, 1900, ii-384, 430.

Recommendations made at meeting of National Fire Protection Association. 1901, i-455.

Testing methods. By R. C. Carpenter, 1900, i-*101.

Tests of centrifugal and steam-jet blowers, to determine relative efficiency.

Tests made in connection with garbage furnace, and reported by B. R. Healey, London. 1901, i-55.

Tests of rotary pressure blowers of Roots type, in Germany. 1904, ii-154. (See also Fans.)

Blowholes in steel ingots. 1902, ii-*261.

Blow-off tank at Northern Power Station of St. Louis Transit Co. 1902, i-*299.

Blue printing:

Automatic continuous feed electric machine, Williams, Brown & Earle. 1903, ii-*436.

Brown Hoisting & Conveying Machine Co. Room and apparatus for making blue prints. 1900, i-*134.

Electric printing apparatus. Drawing room of Pitts. & Lake Erie R. R. By R. P. Forsberg, 1902, i-*4.

Federal electric blue printing machine. Continuous printing. Spaulding Print Paper Co. 1902, i-*464.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Blue printing: (Continued.)

- Home-made electric light blue printing machine. By J. A. Leonard, 1904, ii-*73.
- Printing by the electric light. Equipment manufactured by the General Electric Co. 1901, i-*374, 398.
- Rapid process paper, Latimer formula for. 1904, ii-421.
- Star photo-printing machine. By L. F. Rondinella, 1903, ii-*507.
- Sun printing from blue prints. Using brown paper instead blue. Making blue print from a blue print. 1903, ii-246, 294, 391, 414, 456.
- Toledo plant of the American Bridge Co. Plan of room and notes on apparatus. By R. G. Manning, 1902, i-*325.
- Waterproofing blue prints. 1901, ii-96.

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- American Iron & Steel Mfg. Co. 1902, ii-437.
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- Brooklyn pumping station. 1902, ii-437.
- Chic. & Alton Ry., Kansas City, Mo. 1902, ii-373.
- Chic. & Northwestern Ry., Wells St. power house, Chicago. 1900, ii-397, *422; 1901, i-71.
- Chicago stock yards of Swift & Co. 1902, ii-461, 513, 522.
- English electric light station, Sardinia St., London. Report on bursting of tubes in a Babcock & Wilcox boiler, 1901, ii-*379.
- Investigation in Great Britain. 1902, i-252, 332.
- Penberthy Injector Co., Detroit, Mich. 1901, ii-417, *477.
- Penn. R. R., near Jersey City. Freight engine. 1902, ii-201.
- Republic Iron & Steel Co., Toledo, Ohio. By A. H. Smith, 1903, i-245, *406.
- Steamer "City of Trenton," on the Delaware River. Racing steamboats and exploding boilers. 1901, ii-145, 177, 185, 249.
- "Sudden valve opening theory." Swift Packing Co.'s Works, Chicago. 1902, ii-522.

Boiler furnaces. (See Furnaces; Locomotive boilers and fireboxes.)

Boiler tube cleaner, Turbine, for water-tube boilers. By H. C. Dinger, 1903, i-*329, 330.

Boiler tubes:

- Bursting of, in Babcock & Wilcox boiler, in English station. 1901, ii-*379.
- Corrosion, Relative, of iron and steel tubes. By R. S. Hale, 1903, ii-318.
- Defective welding, Detection of, by chemical means. 1902, i-425.
- Failure of. High temperatures in boiler furnaces and mechanical stokers. By J. J. Dunn, A. Bement, 1903, i-348, 432.
- Nickel-steel, Non-corrosive. Manufacture. Cost of nickel-steel and carbon-steel tubes. Corrosion and oxidation tests. By A. L. Colby, 1903, ii-468.

Boilers:

- Baldwin steam car, C, H. & D. R. R. 1902, i-*103, 104.
- Banked fires, Cost of. 1904, ii-401.
- Capacity of cast-iron sectional steam boilers. Formula. By J. J. Blackmore, 1903, i-116.
- Circulation in steam boilers. Experiments by George Halliday, England. 1900, i-*40, 304.
- Corrosion. Protection against pitting afforded by a thin coating of scale. 1901, i-212.
- Corrugated furnace, Method of construction of. 1900, ii-48.
- Feed water. (See Feed water.)
- Fire-pump boilers. Time required to raise steam for fire pumps from cold boilers and the cost of banked fires. Tests made by Associated Factory Mutual Fire Insurance Companies. 1904, ii-401.
- Fire tubes investigated by C. Bach. 1903, i-357.
- Fusible plugs for steam boilers, Lunkenheimer. 1902, i-*355.

* denotes an illustrated article. † denotes an inset sheet.

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Motor car boilers on European railways. 1904, ii-*77, 80.

Oil circulating systems for obtaining steam at high pressures. 1900, ii-*327.

Philadelphia water-works, 1801 to 1815. Wooden boiler. Cast iron boiler. 1903, i-*422.

Rating of steam and hot water boilers for heating purposes. By James Mackay, 1900, i-109.

Salt-water detector for marine boilers, English. 1900, i-137.

Scale in boilers:

Benefits due to scale. By M. E. Wells, William Kent, 1904, ii-60, 71, 198.

Graphite paint as a scale preventive. 1900, ii-168.

Schenectady steam car boiler, N. Y., N. H. & H. R. R. 1902, i-*102.

Specifications, Uniformity in marine boiler. Report on and bill proposed by American Boiler Makers' Association. 1904, ii-373.

Staybolts, braces and flat surfaces in boilers. By R. S. Hale. 1904, ii-533.

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Superheaters. (See Locomotives, Superheaters; Superheated steam and superheaters.)

Tests at Chicago pumping station, Central Park Ave. By F. A. Whitten, 1904, i-*485, 492.

Tests of efficiencies of the Heine boilers and Babcock & Wilcox boilers. By A. Bement, 1903, i-*521; 1903, ii-37.

Thickness of shell plates for externally-fired return-tubular boilers. Discussion in circular issued by Mutual Boiler Insurance Co. By J. C. Parker, R. S. Hale, 1901, i-80, 121.

Water-level indicators, Paris exhibit of. 1900, ii-107.

Water tube boilers:

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Garbe boiler, manufactured in Germany. 1904, ii-244.

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Parker, Competitive test of, and Babcock & Wilcox boilers at power station of Rapid Transit Co. in Philadelphia. Theory of boiler discussed by O. P. Hood. 1902, ii-457.

Parker boiler with regenerative circulation system. Results of tests. 1901, ii-*127.

Rust Boiler Co. Drums made of pressed tube sheet. 1904, ii-*166.

St. Louis Exhibition plant. 1904, ii-*226.

Sewage pumping station at Jackson Ave. Park, Chicago. 1904, i-*314.

Turgan boiler on steam car. 1904, ii-*80, 114.

Wooden, at Philadelphia water-works, 1801-1815. 1903, i-*422.

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Bolometer. Measurement of heat wave-lengths with Langley invention. 1901, i-297.

Bolts, Lag screw expansion. Steward & Romaine Mfg. Co. 1903, i-*457.

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Argument against long term bonds. 1903, i-347, 388.

Calculation of sinking funds. By Peter Mogensen. 1904, i-284.

Problem in refunding bonds. Formula. 1902, ii-362.

Bookmaking, Modern methods of. 1904, i- Eng. Lit. Sup. March 17, April 14, May 19.

Boom, Rudder. By H. P. Gillette, 1902, i-*473.

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Black diamonds of Bahia, Brazil. 1902, ii-159, 169.

Cost of operating diamond core drills in bed-rock exploration, Gila River, Arizona. By J. B. Lippincott, 1900, i-*34.

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Mary's Lake, Montana. By A. P. Davis, 1903, i-395.

Johannesburg, South Africa, 4800-ft. boring at. 1901, ii-281; 1902, i-1.

Boring and turning mill, 60-ft. vertical, designed by John Riddell. 1903, ii-1.

Boring ice. (See Ice borings.)

Boring machines on Oswego-Mohawk canal survey. Notes on various machines used. Character and cost of borings. By D. J. Howell, 1900, i-*421.

Bosh. (See Blast furnaces, Water cooled.)

Boston:

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Statistics Department, Work of. 1903, i-194.

Subsidence of the land and of the harbor bottom. Report by J. R. Freeman on the proposed Charles River dam. 1903, i-544, 546.

Boston Consolidated Gas Co. takes over other companies. Valuation of property. 1904, ii-488.

Boston Society of Civil Engineers:

Monthly bulletins by excursion committee. 1900, ii-26, 64.

Sanitary Section, First meeting of. 1904, i-128.

Sections organized. Portion of constitution referring to sections. 1904, i-37.

Boulders, Breaking up. 1903, ii-Cons. News Sup. Aug. 16, 20, 27.

Boundary surveys. (See Surveys.)

Bouscaren, Louis Frederic Gustave, Biographical sketch of. By Ward Baldwin, 1904, ii-*453.

Bowles, Francis T., Biographical sketch of. 1904, i-†92.

Brake-pressure device. Adjustable. Russian invention. 1902, i-409.

Brake shoes:

Friction of brake shoes under various conditions of pressure, speed and temperature. By R. A. Smart, 1900, ii-217.

Laboratory tests of 12 brake shoes. Report at Master Car Builders' Association. 1901, ii-6.

Locomotive brake shoes, Tests of, C., R. I. & P. Ry. By W. H. Stocks, 1902, i-159.

Reports of tests by Master Car Builders' Association. 1900, i-429; 1901, ii-6.

Brake valves. (See Air brake valves.)

Brakes:

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Automatic stops as adjuncts to block signal systems. Swiss distance brake. By G. C. Wacker, 1904, i-*108.

Electric street car brakes, Test of, by New York Railroad Commission. 1900, ii-76.

Electro-magnetic track brake. By R. A. Parke, 1903, i-*262.

European cars, Paris Exposition exhibit of. 1900, ii-6.

Freight car brakes. Necessity for uniform braking in the operation of heavy trains. 1900, ii-212.

Friction of street car brakes. Tests by New York Railroad Commission. 1900, ii-77.

Magnetic rail brake for street cars, Westinghouse. 1901, ii-33.

Street car brakes, Tests of, by New York Railroad Commission, Lenox Ave., New York City. 1900, ii-76, 130.

Track brakes:

Electro-magnetic. By R. A. Parke, 1903, i-*262.

Palermo Electric Cable Ry. 1901, ii-*199.

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Brakes, Magnetic, for hoisting motors at Weehawken inclined railway. By C. L. Duenkel, 1902, ii-*307.

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Prony brake test of a horizontal turbine for the Bates Mfg. Co., Lewiston, Me. By W. O. Webber, 1903, i-*386.

Brass removed from iron by electrolysis. By C. F. Burgess, 1903, ii-265.

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Breakwaters:

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Completion of extension to Stony Point. 1903, ii-*281; Cons. News Sup. Oct. 8.

Concrete construction details. By T. W. Symons, 1902, i-*426. By Emile Low, 1902, ii-*182.

Quarrying, Cost of, for rubble and dimension stone. By Emile Low, 1904, ii-*347.

Reinforcement of riprap protection. 1904, ii-*264.

Stone breakwater construction. Quarrying and placing of stone. 1901, i-*346.

Cleveland, Ohio. Solid concrete superstructure. By T. W. Symons, 1902, i-*426.

Cost of concrete structures. By T. W. Symons, 1902, i-432.

Dunkirk, N. Y. Concrete shell superstructure. By T. W. Symons, 1902, i-*426, 432.

Galveston, Tex. Concrete. Abstract of Engineers' Report. 1902, i-77, 343.

Stone breakwater at Buffalo, N. Y. 1901, i-*346.

Welland canal entrance, Port Colborne, Ontario. Construction details. 1902, i-*383.

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Building brick, manufactured by Weston Brick Co. Rain washes off dirt and smoke. 1904, i-32.

Lime-sand brick:

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Manufacture in the United States. 1904, ii-386.

Schwarz drying and mixing machine. 1903, i-*179.

Manufacture of:

Fiske Brick Co., Dover Point, N. H. Automatic machinery. Elimination of hand labor. By J. P. B. Fiske, 1903, i-56, *63.

Western Brick Co., Danville, Ill. 1904, i-*30.

Slag bricks and slag blocks, Manufacture of. By E. C. Eckel, 1903, i-384.

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Tests:

National Brickmakers' Association. Standard testing method for rattler tests. Investigation by Edward Orton, Jr. 1900, i-206; 1901, i-87.

Purdue University. Rattler for testing paving brick. By W. K. Hatt and W. P. Turner, 1901, i-*3.

Rattler tests at Wheeling, W. Va. 1902, i-177.

Report on standard rattler tests by Talbot, Thompson and Eldridge to American Society of Municipal Improvements. 1901, ii-269.

Sand-lime and sand-cement brick, made at Iowa State College. By A. Marston, 1904, i-387.

University of Illinois. Tests for Western Brick Co. of Danville, Ill. Building brick. 1904, i-32.

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- Bricklaying in winter, Stockholm, Sweden. 1903, ii-69.
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 Libel on American bridge work, credited to Sir Alfred Hickman. By
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- Bridge connections, Flexible, for riveted truss, Beuvron bridge, France. 1900,
 ii-29.
- Bridge department, Organization of a working. 1903, i-281.
- Bridge design:
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 Metal bridge systems. 1900, ii-409.
 Graphical method of computing swing bridges. Lindenberger's method.
 1902, ii-*166.
 Problem in design. Stresses in a combined cantilever and three-hinged
 arch. By Edward Godfrey, A. J. DuBois, 1903, i-*255, 348, 349,
 *502.
 Progress in American bridge construction. By H. S. Jacoby, 1902, ii-43.
 Skew connection details, Designing of. Graphical determination of angles.
 By C. A. P. Turner, 1900, i-†126, 146; by C. G. Wrentmore, 1904,
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- Bridge engineering, Essentials necessary for successful practice in. By J. E.
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- Bridge erection:
 Balt. & Ohio R. R., Benwood, W. Va., Novel method. 1903, i-421.
 Chicago, 95th St. Rapid work. Use of electric power. 1903, i-*26.
 Floating spans on barges into position on piers. Fore River, Mass., swing
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Chic., Mil. & St. P. Ry., Chic., R. I. & Pac. Ry., L. S. & M. S. Ry. Chicago track elevation. 1900, i-123, 149

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Viaduct structure on Metropolitan Underground Ry. of Paris. 1903, ii-195.

Washington, D. C., terminal improvements of Balt. & Ohio and Penn. railways. By W. F. Strouse, 1904, ii-418.

Waterproofing bridge floors on the Chicago & Western Indiana R. R. Felt and composition covering, 1904, i-440.

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Discussion at American Society of Civil Engineers. 1903, i-542.

Foorbeam concentrations under wheel loads. Graphical method of finding. By R. H. Bulloch, L. J. Johnson, 1903, i-454, 501.

Limit of wheel loads in modern railway practice. By F. J. E. Spring, W. H. Adamson, 1903, ii-455, 460, 544.

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- Glasgow, Mo., Missouri River, Chic. & Alton Ry. Reconstruction of bridge. By W. D. Taylor, 1901, i-*194.
- Kansas City flow-line bridge repairs after flood of May 31, 1903. By J. A. L. Waddell, 1903, ii-*397.
- N. Y., Chic. & St. L. Ry. Renewal of drawbridge at Lorain. 1904, ii-*256.
- Oregon Short Line R. R. Notes. By W. P. Hardesty, 1903, ii-*331.
- Penn. Ry., New Brunswick, N. J. 1902, i-425.
- Pittsburg, Pa., Pitts., Ft. Wayne & Chic. Ry. Bridge moved 25 feet down stream. 1902, i-301, *336.
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- Bridge spans. Diagrams for determining weights of. By H. G. Tyrrell, 1900, i-*308, 361.
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Bridge specifications:

- Ateh., Topeka & Santa Fe Ry. Steel bridges and viaducts, 1903, i-485.
- Blackwell's Island, East River. Superstructure. 1903, ii-113, 202, 206, 442.
- Comparison of requirements. Tabulated summary. By A. H. Heller, J. L. Campbell, J. P. Snow, 1903, ii-444, 506, 544.
- Concrete specifications, Ill. Cent. R. R. 1901, ii-44.
- East River bridge, New York. 1901, i-290, 454.
- Economical steel and masonry highway bridge, Rye, N. Y. 1900, ii-*412.
- Electric railway bridges. Mass. Board of Railroad Commissioners. 1900, ii-427.
- Footway suspension bridge, Easton, Pa. By H. G. Tyrrell, 1900, ii-*346.
- Proposed specifications for steel railway bridges. By J. W. Schaub, 1900, ii-255, 372.
- Steel, Desirability of using a single grade of. 1902, i-417, 515; 1902, ii-16.
- Steel specifications. American Society for Testing Materials. 1901, ii-11.
- Sydney Harbor bridge, New South Wales. Requirements for unit stresses and material. 1901, ii-58.
- Timber bridge specifications. 1904, i-264.
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Bridge stresses. (See Stresses.)**Bridge works:**

- American Bridge Co., Pittsburg plant near Economy, Pa. 1902, i-*527.
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Atch. Topeka & Santa Fe Ry. Standard plans for bridges. 1903, i-*482.
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Boston bridge, Balt. & Ohio R. R. Raising 250-ft. span 23 feet. 1900, i-401.

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Brooklyn:

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- Observations on the deep pneumatic work of the New East River bridge foundations. By Edwin Duryea, Jr., 1902, i-358.
- Pneumatic caissons. Broad Exchange Building, New York City. 1900, ii-†339.
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- Report of the Canal Association of Greater New York. Reasons for rejecting Ontario route. Engineering News favors Ontario route. 1902, ii-191, 474.
- Major Symons favors inland route and argues against Ontario route. Advantages of Ontario route. By T. W. Symons, R. A. Downey, 1902, ii-264, 265, 267.
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- Railway competition. Effect of small canals on railway freight rates. By G. H. Daniels, L. L. Wheeler, 1902, ii-146, 188, 294.
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Soulanges, Canada. Canal construction. By C. R. Coutlée, 1901, i-*274; 1901, ii-30.

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Carborundum, Value of, in steel manufacture and iron founding. 1900, ii-1.

Carnegie, Andrew:

Gift of building to national engineering societies. (See Union engineering building in New York.)

Organization of manufacturing industries. 1903, i-436.

Prophecy concerning the course of steel prices. 1903, ii-222.

Carnegie, Andrew, and H. C. Frick difficulties. 1900, i-105.

Carnegie and Pencoyd hand-books, Errors in. 1903, ii-13.

Carnegie Institution at Washington. 1902, i-60.

Carnegie Technical Schools of Pittsburgh. 1904, i-514.

Carter, Oberlin M.:

Appeal to United States courts for release from prison. 1901, i-136.

Carter contracts "in the light of to-day." Cost of work at Savannah Harbor and Cumberland Sound compared. By J. H. Bacon, 1903, i-235, *239.

Chronology of Carter case from the beginning. Legislation to secure trial of contractors, 1900, i-105, 240, 256, 265, 304.

Contractors Gaynor and Greene, Case against. 1901, i-145, 369, 385; 1901, ii-297; 1902, i-95, 212, 414; 1902, ii-128.

Habeas corpus appeals denied by United States Supreme Court. 1902, i-17.

Recovery by the Government of the funds lost in the Savannah Harbor work. 1901, ii-366.

Testimony of Mr. R. F. Westcott. 1900, ii-108, 397.

Carting. Time element in loading and unloading carts. Experience of G. H. Parker on Keney Park, Hartford, Conn. 1901, i-54.

Cartridge, Electric, invented by an Italian. 1900, ii-69.

Car axles. (See Axles.)

Car couplers:

Brockelbank automatic, on English freight cars. 1900, ii-*240.

Buhoup three-stem flexible head coupler. 1902, i-*100.

Chic., Bur. & Quincy R. R. Record of defects. By R. D. Smith, 1902, i-423.

Device for taking up slack in automatic couplers. W. F. Gould, inventor. Chic., Rock Island & Pacific Ry. 1902, i-89, *258.

Flexibility in car coupling attachments. Discussion before the Western Railway Club. 1902, i-89, *99.

Improvements in car couplers and draft rigging. Discussion before the Western Railway Club. 1902, i-89, *99.

* denotes an illustrated article. † denotes an inset sheet.

Car couplers: (Continued.)

- Knuckles. Specifications for purchasing and testing separate knuckles for M. C. B. couplers. 1904, i-610.
 - Legal decision as to responsibility of railway companies for keeping couplers in repair. 1902, ii-360.
 - Legislation. Amendments to the Safety Appliance Act. 1902, i-274, 393, 483, 502.
 - M. C. B. couplers:
 - Defects, Record of. Chic., Bur. & Quincy R. R. By R. D. Smith, 1902, i-414, 422.
 - Drop test machine developed by M. C. B. Association. 1900, i-*431.
 - Proposed arrangement of, to give increased flexibility. 1902, i-*100.
 - Report at M. C. B. Association. 1901, ii-6.
 - Prizes for best automatic couplers offered by Congress of Russian Railways. 1902, i-35.
 - Tests of M. C. B. couplers. 1902, i-525; 1903, ii-46.
 - Washburn flexible-head coupler for freight cars. 1902, i-*100.
- Car doors. Hopper door locking and operating device for ore car on the Chic., Mil. & St. Paul Ry. 1901, i-*156.

Car heating:

- Air-pump exhaust for heating passenger trains. Methods on New England roads. 1901, i-335.
 - Electric heating. Influence of heaters on power-station load. 1903, ii-479.
 - Report of M. C. B. Association. 1903, ii-47.
 - Steam mixed with air. Metallic hose with flexible joints. Eastern Ry. of France. 1903, ii-*582.
- Car interchange at Chicago. Improvement of freight traffic discussed. Switching yards of Chicago Transfer and Clearing Co. 1902, i-*8, †12.

Car lighting:

- Avery acetylene system on the Chic., Mil. & St. Paul Ry., Dayton & Union Ry., Pere Marquette R. R. and Canadian Northern Ry. 1901, ii-*426.
 - Discussion of acetylene and electricity at M. C. B. Association. 1902, i-527.
 - Electric lighting unsatisfactory. 1902, i-172.
 - Elliott and Wilson system of acetylene. 1903, ii-281.
 - Great Northern Ry. Experience with acetylene. 1900, ii-147, 189.
- Car record system, Graphic. McNamara invention. Report on use of system by Canadian Pacific Ry. 1900, i-*91.
- Car record of Phil. & Reading R. R. Use of cards and case for the per diem system. 1903, i-258.

Car service rate. 1902, i-449.

Car stop, Hydraulic. 1903, ii-*418.

Car tipple. (See Tipples.)

Car transfer. (See Bridges, Ferry; Ferry steamers, Car transfer.)

Car transfer tables:

- Table and elevator for the J. G. Brill Co., Phil. 1902, ii-*42.
- Tables without pits and traveling on curves. Western Ry. of France. 1904, ii-*307.

Car trucks:

- Derailments, car trucks and car wheels. 1901, i-448.
- Double bolster truck for combination car, Chic., Ind. & Louis. Ry. 1904, i-*150.
- Lindenthal side-bearing truck. By G. Lindenthal, 1904, ii-*262, 267.
- Side-bearing trucks and flange wear. By Gustav Lindenthal, 1904, ii-*261, 267, *449.
- Six-wheel trucks on high-speed electric cars. John Stephenson Co. 1904, ii-*177.
- Steel trucks on the Wisconsin Central Ry. for cars of large capacity. 1900, i-*416.

"1900, ii—112" means "Year, 1900, second volume, page 112."

Car ventilation:

Investigation by American Railway Association. 1901, i-432.
 Safety Car Heating & Lighting Co.'s system. 1901, ii-145.

Car wheels:

Chilled cast iron wheels, Improvements in the quantity of. By C. H. Vannier, 1902, i-258.

Circumference measure of car wheels, Proposed, by M. C. B. Association. 1900, i-*429.

Design for cast iron wheels for 60-, 80- and 100,000-lb. cars. Report of M. C. B. Association. 1903, ii-*46.

Design and wear of car wheels. Discussion by J. Millar, 1904, ii-352.

Flange wear and side-bearing trucks. By Gustav Lindenthal, 1904, ii-*261, 267, *449.

Manufacture of cast iron wheels. Value of thermal and drop tests. Barr drop test machine. Fitting wheels. Analysis of wheels tested under Barr drop and in thermal test. By G. W. Beebe, 1900, ii-*266.

Present and future chilled cast iron car wheels. By William Fawcett, 1901, i-451.

Relative merits of cast iron and steel-tired wheels. 1901, i-471.

Report at M. C. B. Association on cast iron wheels. 1901, ii-6; 1902, i-526.

Specifications for cast iron wheels for 60-, 80- and 100,000-lb. cars. 1904, i-614; 1904, ii-9.

Steel tired, Relative merits of cast iron and. 1901, i-471.

Thermal test of cast iron wheels. Specifications of C., B. & Q. R. R. Drops for testing car wheels. Analysis of wheels tested under Barr drop and in thermal test. By G. W. Beebe, 1900, ii-*266.

(See also Locomotive wheels.)

Cars:

Aurora, Elgin & Chicago Electric Ry. 1902, ii-*283.

Box cars:

Cars with end doors. 1900, i-278.

Cars with riveted trusses. Atch., Topeka & Santa Fé Ry. 1902, i-221.

Outside dimensions of. Report at M. C. B. Association, 1902, i-526; 1903, ii-47.

Standard dimensions of. Preliminary report of M. C. B. Association. 1902, i-6.

Center plates and side bearings for freight cars. Tests of the friction of side bearings and center plates. M. C. B. Association reports. 1900, i-*413; 1902, ii-*38.

Center sills, Metal, in wooden cars. 1902, i-526.

C., C., C. & St. L. Ry. 1901, i-*442.

Chic., Mil. & St. Paul Ry. Wooden ore cars. 1901, i-†456.

Coal:

English railways, Large cars in use on. 1903, ii-304.

Hopper car, New type of steel. Side plates curved. Wellman and Street, inventors. 1903, ii-*419.

Hopper coal cars of 100,000-lbs. capacity. 1902, i-*508.

Vanderbilt 50-ton hopper bottom steel car. West Virginia Central & Pitts. Ry. Comparison with other 50-ton coal cars. 1902, i-*508, 522.

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Combination ballast and coal car, Rodger Pattern. Illinois Central Ry. 1900, i-*5.

Combination ballast and gondola car, Wisconsin Central Ry. Steel truck. 1900, i-*415.

Combination dining, parlor and day cars, Cin., Ham. & Dayton Ry., Chic., Ind. & Louisville Ry., Louisville & Nashville Ry. 1904, i-*149.

* denotes an illustrated article. † denotes an inset sheet.

Cars: (Continued.)

- Compartment day cars on Chicago & Eastern Illinois Ry. 1904, i-523.
- Convertible cars for summer and winter use, Brill design of. Solid frame sides. 1901, i-*339.
- Convertible day, parlor and sleeping car, Strauss. 1900, ii-*363.
- Convertible street railway cars on Brooklyn Heights Ry. and Milwaukee Electric Ry. By Eugene Chamberlain, 1901, ii-292.
- Derrick car for bridge erection, 30-ton steel. 1902, i-*208.
- Derrick car and pile driver combined. 1902, ii-355, *363.
- Dining cars of C., B. & Q. R. R. 1901, i-*442.
- Disinfection of passenger cars with formaldehyde. 1904, ii-74.
- Ditching and spreading car on Bost. & Maine R. R. Work of car satisfactorily. 1901, ii-1.
- Draft gear for freight cars:
- Drop tests by Atch., Topeka & Santa Fe Ry. 1900, ii-365.
 - Drop and tensile tests by M. C. B. Committee, at Altoona, Pa., and at Purdue University. Diagrams and table. 1902, ii-76, 80, 114.
 - Improvements in car couplers and draft rigging. Discussion at Western Railway Club. 1902, i-89, *99.
 - Report on various gears, presented to M. C. B. Association. 1900, i-430; 1901, ii-†13.
 - Westinghouse friction draft gear on 50-ton steel coal cars of Penn. R. R. 1902, ii-*159.
- Dump cars, Ingoldsby, of wood and of steel. Flat bottom divided by central ridge. Tests of cars. 1901, ii-*32; 1902, i-285; 1902, ii-*7.
- Dynamometer cars:
- Chic., Bur. & Quincy R. R. Drawings and particulars of the car and its equipment. 1902, i-*388.
 - Illinois Central Ry. and University of Illinois. Work of car and copies of record charts. 1900, i-98; 1900, ii-*71; 1901, ii-28.
 - Integrator, Mechanical, used in connection with spring dynamometer. Chic., Bur. & Quincy R. R. By M. H. Wickhorst, 1900, ii-*407.
 - Records made by car on New York Central R. R. between Mott Haven and Grand Central Station. Investigation by B. J. Arnold. 1902, ii-80, *83.
- Electric:
- Care in the installation of electric apparatus. Danger from fire in tunnels and on elevated structures. Liverpool accident. Warning from Mr. Westinghouse. Brooklyn accident. 1902, i-1, 8, 17, 68, 172.
 - Central London Ry. 1903, ii-49.
 - Experimental car of the German association for the study of high speed electric railways. Experiments on the Military Railway from Berlin to Zossen. 1901, ii-*304, 308.
 - Garbage cars on the Savannah Electric Ry. 1903, ii-141, 432, *435.
 - High-speed cars. Six-wheel trucks and four 200-HP. motors. John Stephenson Co. 1904, ii-*177.
 - Interurban cars of the Union Traction Co. of Indiana. 1902, ii-*397.
 - Power consumption. Table. 1900, ii-163.
 - St. Louis Transit Co. 1904, i-*620.
 - Single-phase alternating-current car equipped for operating with either direct or alternating current. General Electric system of Schenectady Ry. Co. 1904, ii-*171, 179.
 - Sleeping and parlor cars for Indianapolis & Eastern Electric Ry. 1903, ii-173.
 - Fire engines carried on special trolley car, Springfield, Mass. 1902, i-425.
 - Fireproof construction of electric railway cars. 1902, i-77; 1903, ii-478.
 - Flooring, Cement, called "Monolith." Pullman Co. 1900, i-254.
 - Flooring and siding, Uniform section of. Report at M. C. B. Association. 1901, ii-6.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Cars: (Continued.)

- Garbage electric cars. Savannah Electric Ry. Co. 1903, ii-141, 432, *435.
 Gasoline inspection cars. 1902, ii-221.
 German sleeping cars. 1904, i-535.
 Gondola car, Steel-frame, drop-bottom, level-floor type of. Chic., Bur. & Quincy Ry. 1903, ii-*441.
 Hand and push car. Removable gallows. 1901, i-*175.
 Inspection car on the Northern Ry. of France. Inspection records. 1904, i-*290.
 Interurban electric car. Union Traction Co. of Indiana. 1902, ii-*397.
 Largest cars in the United States. 1900, ii-299.
 Largest freight car in the world. Bethlehem Steel Co. 1903, ii-*24.
 Loading freight cars to their full capacity. 1902, i-252, 264.
 Loading machine for box cars. Handling coal. Ottumwa Box Car Loader Co. 1901, ii-*108.
 Mine cars, Resistance to traction of. Tests by R. Van A. Norris, of Susquehanna Coal Co. 1903, i-57.
 Motor cars on steam railways. Development and handling of local traffic. 1904, ii-*75, 90, 114, 199, *317, 333.
 Observation car of Northern Pacific Ry. 1901, i-*442.
 Ore cars of Chic., Mil. & St. Paul Ry. 100,000-lb. wooden car. 1901, i-†456.
 Painting and maintaining steel cars. By J. D. Wright, W. O. Quest, 1903, ii-315.
 Parlor car of C., C. & St. L. Ry. 1901, i-*442.
 Rail transportation on cars by Lake Terminal Ry. and Clev., Lorain & Wheeling Ry. 1901, i-†343.
 Side-bearings of freight cars. Should they be in contact? Tests of the friction of side-bearings and center plates, M. C. B. report on. 1900, i-413; 1901, i-449; 1902, i-326; 1902, ii-38; 1903, ii-*45.
 Side-door suburban car on Illinois Central R. R. and Wabash Ry. Steel-frame construction. 1903, ii-*211, *476, 478, 521; 1904, i-*539.
 Special car for high-speed local service on the Dayton & Union R. R. 1901, ii-*424.
 Splicing passenger car sills. Report at M. C. B. Association. 1902, i-*526.
 Spreader car of the Boston & Maine R. R. 1900, i-*427.
 Standard dimensions for box cars. Preliminary report of M. C. B. Association. 1902, i-6.
 Statistics of construction, 1898-1902. 1902, ii-540.
 Steam motor cars:
 Experience of the N. Y., N. H. & H. R. R., Erie R. R., C. H. & D. Ry., P., C., C. & St. L. Ry., Erie & Wyoming Valley R. R. 1902, i-*102, 112.
 French railway from Paris to Dijon, using petroleum fuel. 1903, i-116.
 London & Southwestern Ry., England. Trial. 1903, i-397.
 Possibility of designing a successful car. 1902, i-112.
 Street railway use of, in Yucatan. Built by John Stephenson Co. 1903, i-117.
 Steel cars:
 Balt. & Ohio R. R. coal cars. 1902, i-361.
 Box cars of 80,000 lbs. capacity. Atch., Top. & Santa Fe Ry. 1901, i-358.
 Comparison of hopper-bottom gondola and box cars as to weight and capacity. 1904, i-114.
 Development of steel freight cars. Action of the M. C. B. Association on the steel car question. 1904, i-3.
 Framing for freight cars, Proposed. By G. W. Scott, E. W. Summers, 1901, i-*227, 295, 337.
 Framing for passenger cars. Letter from A. W. Sullivan of Ill. Cent. R. R. 1904, i-352.

* denotes an illustrated article. † denotes an inset sheet.

Cars:

Steel cars: (Continued.)

- Freight car designs by R. W. Oswald. 1904, ii-*32.
- Gondola cars of 88,000- and 100,000-lbs. capacity on Chic. & Alton Ry. 1903, i-*202.
- Hopper-bottom coal cars of 50-tons capacity on the Penn. R. R. Westinghouse friction draft gear. Comparison of cars of several railways. 1902, ii-*159.
- List of articles published in Engineering News. 1904, i-5.
- Maintenance and repair. Experience with freight cars. 1904, i-600.
- Need of steel frames illustrated by railway accidents. 1904, ii-71.
- Passenger car construction. By William Forsyth, 1904, i-*608, 612; 1904, ii-9.
- Prices for repairs. Report of M. C. B. Association. 1904, i-618.
- Review of steel car situation. 1904, i-13.
- Rust prevention. Suggestions by M. C. B. Association. 1904, i-617.
- Southern Ry. of France, Cars of large capacity on. 1904, i-467.
- Spain, Cars shipped to, by Pressed Steel Car Co. 1901, ii-49.
- Standards for steel car construction. 1901, i-284.
- Wrecks of steel cars. 1901, ii-*213.
- Tank car for gravity tramways. By F. B. Freeman, A. S. Hobby, 1903, i-253, *302, 369.
- Tank car with riveted truss frames. 1902, ii-*492.
- Track-moving car. 1902, ii-224.
- Weighing cars. (See Track scales.)
- Wooden box and coal cars of 100,000-lbs. capacity on the Southern Pacific Ry. 1900, ii-42.
- Wooden gondola cars of 80,000-lbs. capacity on Chic. & Alton Ry. 1903, i-*202.
- Case, J. I., Threshing Machine Co., Racine, Wis. Physical and chemical laboratory. Specifications for foundry supplies. 1902, ii-*35, 184.
- Cast iron. (See Iron.)
- Casting:
 - Melting steel with iron in the cupola. Tests. By H. E. Diller. 1902, i-495.
 - Sauveur overflow method of casting pipeless ingots. "Piped ingots and piped rails." By Albert Sauveur, 1903, ii-31, 80.
- Casting machine for pig iron. Hartman & Co., Phil. Rotating table. 1900, ii-321.
- Castings:
 - Burning or mending castings, Experience in. By E. B. Gilmore, 1900, ii-*351.
 - Calculation of the weight of castings with the aid of the planimeter. By C. M. Schwerin, 1902, ii-*274.
 - Direct-metal and cupola-metal iron castings. By T. D. West, 1904, i-248.
 - Malleable cast iron. By H. E. Diller, 1902, ii-499; Richard Moldenke, 1903, i-531.
 - Physical properties of malleable castings as influenced by the process of manufacture. By Richard Moldenke, 1903, ii-45.
 - Specifications for gray iron castings, Proposed standard for. Molding of test pieces. 1901, ii-*76.
 - Specifications for foundry castings, J. I. Case Threshing Machine Co. 1902, ii-186.
 - Specifications for pig-iron and iron castings. Phil. & Reading Ry. Co. By Robert Job, 1904, i-253.
 - Strength of white-iron castings as influenced by heat treatment. By A. E. Outerbridge, Jr., 1903, i-458.
- Catalogue, Spelling of. 1904, i-13.
- Catalogues, Trade, Standard sizes for. 1902, ii-123; 1903, ii-478.
- Cataloguing books, Cost of. 1902, i-105.
- Catalpa plantations. (See Tree planting.)

"1900, ii—112" means "Year, 1900, second volume, page 112."

Catch basins. (See Sewers.)

Cathode ray alternating current wave indicator. By H. J. Ryan, 1903, ii-44, *189.

Cattle guards:

Combination pit and surface. Wallace invention. 1900, ii-*268, 358.

Discussion of fences and cattle guards at Roadmasters' and Maintenance of Way Association. 1902, ii-221.

Position of, at road crossings. Recommendation of Canadian Cattleguard Commission. 1903, i-*275.

Reports at American Railway Engineering and Maintenance of Way Association. 1903, i-282; 1904, i-264.

Requirements of the Canadian Government Commission. 1902, ii-389.

Rutland Canadian R. R. Details of surface guard. By J. W. Burke, 1903, i-*49.

Cells, Standard. Discussion at American Electrochemical Society. 1904, i-349.

Cement:

Adhesion tests of cement mixtures at power plant, at Chaudiere Falls, Quebec, and described by J. S. Costigan. 1902, ii-262.

Analysis of cements:

Constitution of Portland cement from a physico-chemical standpoint. By Clifford Richardson, 1904, ii-123.

Several brands of Portland cement analyzed. Table showing variation in analysis compiled by E. Duryea. 1902, i-23.

Standard method proposed by the Committee on Uniformity in Technical Analysis. 1903, ii-60.

Blast furnace slag for Portland cement manufacture. By Cecil von Schwarz, 1900, ii-210.

Boiling test for Portland cement. 1904, i-585.

By-products, Possible, in the Portland cement industry. By Clifford Richardson, 1904, i-585.

Chemical composition of representative foreign and American Portland cements. 1900, i-376.

Clay and loam, Effect of:

Tests by Ames and Stellhorn under supervision of C. E. Sherman. Concrete highway bridge, Yellowstone Park. By C. E. Sherman, 1903, ii-443.

Tests made at Golden Gate bridge in the National Park. By J. M. Lewis, 1904, i-107.

Consistency, Determining, by use of the Vicat needle apparatus. Report by American Society of Civil Engineers. 1903, i-109.

Constitution of Portland cement from a physico-chemical standpoint. By Clifford Richardson, 1904, ii-127.

Cost of cement at Tonto dam, Arizona. 1904, i-24.

Cost of Portland sand-cements. Tests of cement for Gila River dams. By Edward Duryee, 1903, i-487.

Fatigue of cement products. Experiments at St. Louis, Mo. By J. L. Van Ornum, 1903, ii-35, 403.

Fineness of grinding. Statements of manufacturers as to the increased cost of fine grinding. By E. Duryee, W. S. Pilling, E. C. Eckel, S. E. Thompson, 1902, i-24; 1904, ii-112, 181, 199, 220.

Forcing cement into quicksand. By R. C. Beardsley, 1902, ii-316.

Formulas for computing the cement required in concrete. By R. E. Horton, H. P. Gillette, 1902, i-438, 482.

Freezing of cement:

Tests of cement mixtures at power plant at Chaudiere Falls, Quebec, and described by J. S. Costigan. 1902, ii-261.

Tests of Portland cement mortar exposed to cold, at New Croton dam, Ossining, N. Y. By C. S. Gowen, 1903, ii-98.

Hydraulic cement. Interpretation of term "hydraulic." 1903, i-411.

* denotes an illustrated article. † denotes an inset sheet.

Cement: (Continued.)

Inventor of Portland cement, Joseph Aspdin, Memorial to, at Leeds, England. 1903, ii-499.

Keene's cement. By E. C. Eckel, 1903, i-108.

Manufacture:

America, Development in, and future prospects. 1900, ii-60.

Blast-furnace slag, Utilization of, in cement manufacture. By Cecil von Schwarz, 1900, ii-*210.

First manufacturers by the direct rotary kiln process at Rondout, N. Y., and Colton, Cal. By E. Duryee, 1900, ii-62.

Heat, Quantity of, required to burn cement. By W. H. Stanger, Bertram Blount, 1901, ii-317.

Illinois Steel Co.'s manufacture of cement. 1900, ii-148.

Influence of the rotary kiln on the development of Portland cement manufacture. By J. G. Sanderson, 1900, i-288, 361.

Marl and clay, Manufacture of cement from. By H. S. Spackman, 1903, i-492.

Michigan, Notes on various plants. 1901, ii-262.

New York State, Portland cement industry in. Early history. Descriptions of plants. By E. C. Eckel. 1901, i-365, 398.

Portland cement in the United States. Opportunities for the chemical engineer in the ceramic industry. By Edward Orton, Jr., Clifford Richardson, R. W. Lesley, 1904, i-45, 155, 156.

Portland cement manufacture from blast-furnace slag. Paper by Cecil von Schwarz. 1903, i-469.

Rotary kiln process, Theory and practice of. History of the process. By W. H. Stanger, Bertram Blount, 1901, ii-308, *315, *334.

Separators—why they are not used in Portland cement works. By E. C. Eckel, 1904, i-344.

(See also Cement works.)

Maturing process patented by F. W. Cappelen. 1903, ii-60.

Measuring cement for concrete work on Aurora, Elgin & Chicago Electric Ry. 1902, ii-285.

Measuring cement loose or packed, The practice of. By B. C. Yates, T. W. Allen, 1903, ii-368, 480, Cons. News Sup., Nov. 5.

Michigan Alkali Co.'s plant for manufacturing cement from caustic soda water. By B. B. Lathbury, 1900, ii-*372, 376, 394.

New Orleans drainage work. Use of cement not named in specifications. Attack on Chief Engineer Harrod. 1902, i-172, 288.

North Riverside & Jarupa Canal Co., Cal. Method of cementing. By E. Duryee, 1901, i-*140.

Notes on cement masonry. 1902, ii-328.

"Pedigree" clause in specifications for cement. By W. H. Herschel, 1904, i-424, 542.

Plasters and hard finishing cements in the United States. By E. C. Eckel, 1903, i-107.

Powder in cement, Methods of determining the proportion of. By A. W. Munsell, 1904, ii-91.

Prices and demand in the Portland cement trade. 1904, ii-403.

Production:

Failure of German syndicate to control production and prices. 1902, ii-89.

Production of hydraulic cement in United States. 1902, ii-1.

Production of Portland cement in 1903. 1904, ii-406.

Review of American cement industry in 1902-1903. By E. C. Eckel, 1904, i-191.

Raw materials employed and the amount of Portland cement made from each in the United States. By E. C. Eckel, 1903, i-339.

Raw materials for the manufacture of Portland cement, Michigan Alkali Co. By B. B. Lathbury, 1900, i-*372, 376.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Cement: (Continued.)

Report of Board of Engineers, U. S. Army, on the properties and testing of hydraulic cement. 1901, ii-180.

Report of American Society for Testing Materials. 1903, ii-32.

Retarding the setting of cement by continuous mixing after wetting. Tests. By G. Y. Skeels, 1902, ii-382.

Sand:

Desirability of abandoning sand tests. By P. J. Cleaver, A. W. Carpenter, 1901, i-169, 211.

Effect of combinations of sand on the setting and strength of cement. By E. S. Larned, 1903, ii-128.

Sand-cement for concrete works remote from transportation lines. Tests of cement for the Gila River dams. By Edward Duryee, 1903, i-487.

Standard sand. 1903, i-110.

Sea water, Decomposition of cement by. Remedy proposed by Dr. Michaelis. Discussion by H. Le Chatelier. 1901, i-358; 1901, ii-108.

Slag:

Adulteration in Portland cements, Method of determining. By W. K. Hatt, 1901, i-164, 168, 192.

Nature and properties, chemical analyses, mechanical strength of foreign and domestic brands. Development of slag industry. By W. K. Hatt, 1901, i-164, 168, 192.

Utilization in Portland cement. Illinois Steel Co., Clinton Iron and Steel Co., German and Belgian works. 1900, i-369, 394.

Slag cement manufacture:

Alabama. Birmingham Cement Co, and Southern Cement Co. By E. C. Eckel, 1902, i-62.

Review of the Census Bulletin on the utilization of wastes and by-products. 1902, ii-65.

Soundness tests of Portland cement in Philadelphia Testing Laboratories. Proper age of test pieces. By W. P. Taylor, Jr., R. W. Lesley, P. C. McArdle, T. H. Loomis, 1903, ii-*81, 100, 123, 205, 246.

Specific gravity. Use of Le Chatelier apparatus. By E. Duryee, 1902, i-24; 1903, i-*109.

Specifications:

Canadian Society of Civil Engineers. 1903, i-129.

Comparisons of American, German, French and Russian specifications for testing Portland cement. By E. Duryee, 1902, i-23.

Departure from, New Orleans controversy and attacks on Mr. Harrod. 1902, i-172, 288.

Report by Board of Engineers, U. S. Army, on properties and testing of hydraulic cement. 1901, ii-183.

Report on specifications for natural and Portland cement by American Railway Engineering and Maintenance of Way Association. 1903, i-285.

Specifications for natural and Portland cement by American Society for Testing Materials. 1904, i-619.

Sulphate of lime and tests for free lime. By E. Duryee, 1902, i-23.

Tonto dam, Arizona. Bids asked. Possibility of a government cement-making plant. By W. G. Hartranft, 1904, i-24, 177, 223, 259.

Water in cement, Effect of, and of combinations of sand, on the setting and strength of cement. By E. S. Larned, 1903, ii-100, 128.

Weights of Portland cement and capacity of cement barrels. Tests made by Boston Transit Commission in 1896. By S. E. Thompson, 1900, ii-229.

(See also Concrete; Lime.)

Cement barrels, Capacity of:

Tests by Boston Transit Commission in 1896. By S. E. Thompson, 1900, ii-229.

* denotes an illustrated article. † denotes an inset sheet.

Cement barrels, Capacity of: (Continued.)

Variation in size of barrels. By H. P. Gillette, 1901, ii-423.

Variation in size of barrels and in specification units. By T. C. J. Bailey, Jr., S. E. Thompson, 1903, ii-318, 434.

Cement bins. (See Bins.)

Cement briquettes:

Compacting sand briquettes, Ramming device for, used in laboratory of N. Y. C. & H. R. R. R. By A. W. Carpenter, 1902, i-*30.

Manipulation of briquettes. 1904, ii-593.

Molding dry and hardening by immersion in water. Experiments by W. A. Aiken. 1904, i-585.

Standard form and dimensions for tensile tests. 1903, i-*110.

Superiority of hand molded over machine molded briquettes. By A. A. Riffle, 1902, ii-130.

Cement exhibits at the St. Louis Exposition. 1904, ii-*407.

Cement grips, Form of, recommended by the American Society of Civil Engineers. 1903, i-*110.

Cement grout. (See Grouting, Cement.)

Cement kilns:

Bronson Cement Co. Kiln for burning wet materials. 1901, ii-*319.

Chamber kiln for burning Portland cement. 1901, ii-*316.

Combustions in Portland cement kilns. Rotary vs. dome kilns. By Edward Duryee, 1900, ii-*82.

Dietsch continuous kiln for burning Portland cement. 1901, ii-*316.

First manufacturers of Portland cement by direct rotary kiln process. By Edward Duryee, 1900, ii-62.

Hecla Portland Cement & Coal Co., Bay City, Mich. 1904, i-245.

Hurry & Seaman rotary kiln used by the Atlas Cement Co. 1901, ii-*318.

Ransome rotary kiln. 1901, ii-*316.

Rotary kilns:

Hudson Portland Cement Co., Hudson, N. Y. 1903, ii-*70.

Influence of, on the development of Portland cement manufacture in America. By T. G. Sanderson, 1900, i-288, 361.

(See also their names.)

Rotary kiln process of cement manufacture. By W. H. Stanger, Bertram Blount, 1901, ii-308, *315, *334.

Stokes rotary kiln. 1901, ii-*317.

Vulcan Iron Works rotary kiln. By W. H. Stanger, Bertram Blount, 1901, ii-*338, *340.

Cement literature. 1903, i- Eng. Lit. Sup., Feb. 19.

Cement mixing:

Drum mixer for dry cement and sand in the laboratory of the C., M. & St. P. Ry. Co. By C. J. Griesenaur, 1902, ii-*100.

Method recommended by the American Society of Civil Engineers. 1903, i-110.

(See also Concrete mixing.)

Cement molding machine of Cement Products Co. 1904, ii-*443.

Cement storage tanks, Concrete-steel, of Illinois steel Co. 1902, ii-148.

Cement testing laboratory, Model, at St. Louis Exposition. 1904, ii-*407.

Cement testing machines:

Home-made testing machine by P. F. Brendlinger. 1903, ii-*278.

Machine for automatically testing the tensile strength of cement briquettes. Falkenan-Sinclair Machine Co. 1903, ii-*227.

Machine for determining rate and time of setting of cement mortars. By E. B. Kay, 1901, ii-*95.

Cement tests:

Buffalo breakwater construction. Lehigh Portland cement. By T. W. Symons, 1902, i-431.

Effect of clay and loam on cement mortar. Tests made under supervision of C. E. Sherman. Concrete viaduct at Golden Gate, Yellowstone Park. By C. E. Sherman, 1903, ii-*443.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Cement tests: (Continued.)

- Effect of salt and fresh water, of heating and freezing. 1903, i-548.
 Effect on the tensile strength of cement of removing briquettes from water for varying lengths of time before breaking. By J. L. Van Ornum, H. P. Boardman, 1904, i-24, 107.
 Fallacy of the tests ordinarily applied to Portland cement. By R. K. Meade, 1904, i-391.
 Manhattan Ry. Co.'s power station, N. Y. City. Retempering cement mortar. Molding briquettes. Relation between tensile strength and modulus of rupture. High strength short-time tests. Imbedded wire. By T. S. Clark, A. A. Riddle, 1902, ii-67, 114, 130.
 New York Rapid Transit Railway tunnel work. Inspecting and testing cement. By H. A. Young, W. P. Taylor, P. J. Cleaver, 1902, ii-242, 316, 362, 382.
 "Owl" Portland cement laboratory of Illinois Central R. R. 1903, ii-427.
 Proper manipulation of tests. Report of American Society of Civil Engineers. Symposium of opinion. 1900, i-408.
 Report of the American Society of Civil Engineers on uniform tests for cement. Studies and experiments, 1897-1902. 1903, i-*109, 152.
 Simple and rapid tests for cement. (From City Roads and Pavements. By W. P. Judson.) 1902, ii-166.
 Testing of cement by large users. 1903, i-60.
 (See also Lime.)

Cement works:

- Barcelona, Spain. Compania General de Asfaltos y Portland. 1904, i-*417.
 Bronson Portland Cement Co. Cable haulage for transporting marl to the mills. 1904, i-*56.
 Buckhorn Portland Cement Co., West Va. By R. L. Humphrey, 1903, ii-*408.
 Edison Portland Cement Co.:
 New Village, N. J. 1903, ii-*555, 567.
 Stewartsville, N. J. 1902, i-*432.
 Hecla Portland Cement & Coal Co. Plant and building at Bay City, Mich. 1904, i-*243.
 Hudson Portland Cement Co., Hudson, N. Y. Use of limestone and shale. Rotary kiln dry process. 1903, ii-*70.
 Cementing power of road materials. By L. W. Page and A. S. Cushman, 1904, ii-441.
 Cementing value of rock powders, Cause of. By A. S. Cushman, 1903, ii-131.
 Central States Water-Works Association, Conventions. 1900, ii-180, 185; 1901, ii-296; 1902, ii-259; 1903, ii-278.
 Central station in Phipps power building, Pittsburg, Pa., furnishes various forms of power to surrounding buildings. By G. E. Flanagan, 1904, ii-*236.
 (See also Electric lighting; Electric power; Electric railways; Heating and ventilation.)
 Centrifugal machines and their uses. By Bartholomew Viola, 1902, ii-*506; 1903, i-13.
 Centrifugal railway at Revere Beach, Mass. By M. F. Brown, 1900, ii-*342.
 Ceramic industry and opportunities for the chemical engineer. By Edward Orton, Jr., Clifford Richardson, R. W. Lesley, 1904, i-45, 155, 156.
 Chain tape, Spliced. By W. S. Bastian, 1901, i-*153.

Chains:

- Chains and chain gearing. By Charles Piez, 1901, ii-*152.
 Detachable links. French invention. Tests at Charlottenburg. By F. A. Mahan, 1903, i-*393.
 Rolling chain cables direct from steel bars. 1901, i-268.
 Charcoal briquettes from wood waste in Sweden. 1902, i-7.
 Charcoal plant, By-product, of the Lake Superior Power Co. By E. A. Sjoestedt, 1902, i-*21, 175.
 Charters. (See Municipal government.)

* denotes an illustrated article. † denotes an inset sheet.

Checking arithmetical calculations, Methods of. By Willis Whited, 1900, i-159, 226, 227.

Chemical analysis, Proposed standardization of methods of. By Bertram Blount, 1902, ii-350, 360.

(See also Sewage analyses; Water analyses.)

Chicago:

Enlarging of business district proposed. By P. F. Barr, 1901, ii-159.

Municipal engineering in. By L. E. McGann, 1900, i-24, 30.

Chimneys:

Caisson foundations at Asnieres, near Paris. Sewage disposal work. 1900, i-417.

Concrete, at Bellinzona, Switzerland. By W. W. Christie, 1901, ii-*197.

Concrete, Reinforced:

Bellevue, Mich. 182-ft. chimney. 1904, ii-*579.

Constable Hook, N. J., Elizabethport, N. J., Jersey City, N. J., and South Bend, Ind. All built under Ransome system. By J. D. Schuyler, W. W. Christie, 1903, i-309, 326.

Laclede Fire Brick Co., St. Louis, Mo. Weber system. 1903, i-*310.

Pacific Electric Ry. Co., Los Angeles, Cal. Ransome system. By J. D. Schuyler, 1903, i-*308.

Separate lining for chimney. Central Lard Co., Jersey City, N. J. 1901, ii-†463.

Corrosion of steel stack. 1904, i-494, 541, 589.

Demolition of 150-ft. brick chimney by dynamite, Washington, D. C. By W. J. Douglas, 1902, ii-*484.

Design of chimney stacks in Germany. 1902, ii-35.

Foundation design. 1900, i-161.

German dust arrester and ventilating chimney at Clinic Institute, Halle, Germany. Two cast iron chimneys within brick tower. 1901, i-*135.

Large chimney at Schenectady Locomotive Works. 1900, ii-358.

Moving a brick lined steel smokestack 85 feet high, 450 feet. 1900, ii-257.

Moving a 110-ft. steel chimney at Orange Valley, N. J. 1903, i-*380.

New Brighton, S. I. Chimney 365 feet high. 1901, ii-1.

Orford Copper Co., Bayonne, N. J. Chimney 365 feet high for discharging acid vapor. 1901, ii-*398.

Plumbing a chimney during construction, Novel method of. Lawrence, Mass. By F. M. Goodhue, 1904, ii-311.

Repairing a steel chimney in an office building. American Surety Building, New York. 1902, i-236.

Steel:

Descriptions of chimneys of St. Louis Transit Co., Cincinnati Gas & Electric Co. and Osceola Consolidated Copper Co. 1901, ii-†466.

High chimneys. By W. W. Christie, W. C. Coffin, 1904, ii-73, 99, 199.

Steel stack erected complete at West Albany, N. Y. 1902, ii-88.

China:

Chinese artillery and arsenals. 1900, ii-44.

Chinese engineering. Water wheels. Bridges. By L. F. Bellinger, 1902, i-*494.

Commercial influence of railways upon foreign trade of China. 1900, ii-1.

Chloride of lime, Weakness of that sold in Washington, D. C. 1902, ii-435.

Chlorine in metallurgy. By James Swinburne, 1904, ii-304.

Chlorine map showing normal waters of Long Island. By G. C. Whipple, 1900, i-384.

Cincinnati to Portland, Oregon. Notes. 1900, i-257.

Cinders for sewage filter beds, Notes on the cost of. By Ernest McCullough, 1904, ii-136, 151.

Circular letters, Seeking engineering advice by, instead of employing an engineer. 1902, i-370.

"1900, ii—112" means "Year, 1900, second volume, page 112."

Civic museum in memory of Andrew H. Green proposed for New York City. 1904, i-588.

Civil engineering:

Century of civil engineering. By J. J. R. Croes, 1901, ii-2.

"Close" profession. Efforts to secure legislation in Canada. 1902, i-230, 241.

Definition of. By G. S. Walker, 1903, i-524, 567; 1904, ii-8.

Engineers and engineering. By J. F. Wallace, 1900, ii-49.

Profession of. By J. F. Crowell, 1904, i-562.

Civil engineering corps, Organizing. By F. H. Newell, 1904, ii-58.

Civil Service examinations:

Aid in the U. S. Coast and Geodetic Survey. Character and prospects of position. 1902, ii-249, 291.

Chicago:

Chief Sanitary Inspector. 1904, i-72.

Structural iron designers. Lists of questions. 1900, ii-1, 352; 1903, i-19.

Criticism of Civil Service methods. How should inspectors be appointed? Concerning the merit system. Draftsmen and instrument-men in the New York Municipal Service. 1904, ii-448, 487, 525, 545.

Draftsmen for the Navy. 1902, ii-73, 157.

Draftsmen for structural steel-work in the Department of Yards and Docks. 1901, ii-17, 65.

Engineers for the Navy:

Chicago and New York examinations, Feb. 23, 1903. 1903, i-89.

List of questions for assistant civil engineers. 1903, ii-145.

New York, April 30, 1901. 1901, i-286.

New York, Jan. 9, 1905, for assistant civil engineers. 1904, ii-454, 575.

Questions of Dec. 1900. 1902, i-349, 513.

Rules governing appointments. 1900, ii-305; 1904, ii-74.

Engineers on the New York barge canal:

Abstract from "Manual of Examinations." 1903, ii-441.

Questions asked. 1904, i-111.

Municipal examinations, Bad features of. 1903, i-481.

Superintendent of water-works at Columbus, Ohio. Questions. 1901, ii-219.

U. S. Geological Survey. Assistant topographer and topographic aid. 1903, i-165.

Clarke, Thomas Curtis, Obituary of. 1901, i-451.

Clay:

Analysis of clay and shale used by Hudson Portland Cement Co. 1903, ii-70.

Artificial clay in Germany. 1902, i-165.

Fusibility of, Effect of fineness of grain on. By Heinrich Ries, 1903, ii-111.

Plasticity of clays, Cause of. By A. S. Cushman, 1903, ii-131.

Unrecorded property of clay and irrigation as a cause of landslides. By O. F. Wasmansdorff, J. P. Wadhams, H. M. Cambie, 1903, i-34, 38, 104.

Clayton, Earle, an impostor. By R. M. Clayton, 1903, i-391.

Clearing and grubbing, Methods of paying for. By J. T. Dodd, 1903, ii-592; T. H. Mather, Woolsey Fennell, G. W. Stadly, 1904, i-38, 63; Cons. News Sup., Jan. 14.

Clinker. (See Garbage cremation.)

Clips, Steel, in steel frame building construction. Invention of H. A. Streeter. 1900, ii-*195.

Cloud distances, Measuring, from a railway train. 1902, i-*250, 252.

Clutch. (See Friction clutches.)

* denotes an illustrated article. † denotes an inset sheet.

Coal:

Burning Illinois coal without smoke. By L. P. Breckenridge, 1903, i-519;
By A. Bement, 1903, ii-59.

China, Report upon coal fields of. 1900, i-45.

Coming exhaustion of nature's stores. 1901, i-80.

Comparative tests of coal and crude oil as fuel. By J. E. Denton, of
Stevens Institute. 1902, i-*80.

Labor cost of production, 1901. 1902, ii-403.

Nova Scotia, Dominion Coal Co. 1900, ii-187.

Ohio, Vinton and Jackson counties in. Economic value of the Clarion
coal. By N. W. Lord, 1901, ii-118.

Pennsylvania anthracite coal fields. 1902, i-229.

Powdered coal:

Aero-pulverizer system of powdered fuel combustion. 1901, ii-*416.

Alpha Cement Co., Alpha, N. J. Use of powdered fuel in boiler
furnaces. Tests. 1901, i-448, *452.

Cyclone pulverizer system of powdered fuel combustion. 1901, ii-*415.
Indianapolis Water Co. Machinery used. Results obtained. 1903,
i-77.

Plant for pulverizing coal, at pumping station of Indianapolis Water
Co. 1902, ii-201, 281.

Rotary brush apparatus for feeding coal to a boiler furnace. By J. M.
Sweeney, 1904, i-*252.

Rotary brush system of feeding pulverized fuel to furnaces, Schwartz-
kopff system. 1902, i-*147.

Rowe and Bender burning system. Feeder and burner applied to steam
boiler. 1902, ii-*548; 1903, i-37.

Westlake system of burning. Tests by Faber du Faur & Donnelly.
By A. C. Hesselmeyer, 1901, i-*178, 230.

Spontaneous combustion of coal. Reduction of risk from fires caused by
soft coal. (Circular issued by Home Insurance Co.) By A. O.
Doane, 1904, ii-141, 409.

Storage of coal. Experiments at Alexandria Docks, England. 1903,
ii-256.

United States, Notes on coal fields. 1902, i-256, 297, 315.

Virginia anthracite field. By L. L. Randolph, 1904, ii-353.

Coal bins. (See Bins.)

Coal breakers:

Electric, at Auchincloss Colliery of the Lackawanna R. R. 1902, i-381.

Stockett, Cascade County, Mont., for bituminous coal. By Lewis Stockett,
1904, i-*270.

Coal briquetting machinery. San Francisco & San Joaquin Coal Co. 1903, i-337.

Coal chutes, Adjustable, Phil. & Read. R. R. 1903, i-*471.

Coal consumption of warships, Methods of estimating. By D. W. Taylor,
1904, ii-38.

Coal consumption, steaming radius and the most economical speed of steam
vessels. Report by M. E. Cooley. 1900, ii-263.

Coal cutting machine, Electric, of Sullivan Machinery Co., Chicago. Records
made at Vesta Coal Co.'s mine, Allenport, Pa. 1901, ii-*400;
1904, ii-*211, 270.

Coal dust as fuel. 1904, i-72.

Coal grinding machine of Alpha Cement Co. Powdered fuel for boiler fur-
naces. 1901, i-*452.

Coal handling:

Aurora, Elgin & Chicago Electric Ry., Batavia, Ill. Plant of novel design.
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Box-car loading machine, Ottumwa. 1901, ii-*108.

Charleston Navy Yard. Tower wrecked by wind. 1904, ii-312.

Clarke automatic coaling and weighing barge for coaling steamships.
1901, i-*445.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Coal handling: (Continued.)

- Cunningham-Seaton system of coaling war vessels. Use of water jet between vessels. 1904, i-*69.
- Dominion Coal Co. at Louisburg, Cape Breton. Shipping pier and belt conveyors. 1902, ii-*428.
- Dumping machines. McMyler, Brown and Wellman-Seaver-Morgan machines. 1904, i-*267.
- Economy in handling coal. 1904, ii-288.
- Electric plant in New York harbor for transferring coal from boats to stock pile. 1901, ii-478.
- Frenchman's Bay, East Lamoine, Me. By J. A. McNicol, 1902, ii-*58; 1904, ii-202.
- Highland Boy mine, Bingham, Utah. Hoisting apparatus, raising coal to tramway for transportation to mine. By W. P. Hardesty, 1902, ii-*60.
- Lehigh Valley R. R., Newark, N. J. Coal pockets. By W. G. Berg, 1903, i-*304.
- Locomotive plants:**
- Auxiliary coaling stations. Several systems described. Table of coaling stations. Recommendations. 1902, ii-354, 358.
- Balt. & Ohio R. R., Hyndman, Pa. Two-pocket coaling station and ash-handling plant combined. 1902, i-221.
- Coal handling by railways, Report on. 1902, i-248.
- Fond du Lac, Wis., Wisconsin Central Ry. Details of coal storage and coal handling plant for supplying locomotives. 1902, ii-*440.
- Phil. & Read, Ry., Philadelphia. 1901, ii-*102.
- Plants of various railways. Report by Robert Quayle, D. Van Alstine and G. M. Basford. 1901, i-*473; 1902, ii-*116.
- Lowell Gas Light Co., Lowell, Mass. Steel and concrete construction. Notes on New York power stations. Handling and storage plant. By F. M. Bowman, 1902, i-*463.
- Manila, P. I. Naval coal handling and storage plant. 1902, ii-*91.
- Miller cableway for coaling vessels at sea. 1900, i-*220; 1902, ii-371.
- Milwaukee Electric Railway & Light Co., Milwaukee. Novel hoisting plant. Wagon body lifted to top of building. 1904, i-*183.
- New London, Conn., U. S. Naval Station. Construction details of plant. 1900, i-*38.
- New York Navy Yard. Concrete and steel storage and handling plant. By J. S. Shultz, 1904, ii-*68.
- New York rapid transit railway power house coal and ash plant. 1904, i-*41.
- Progress made in coal unloading machinery on wharves and vessels. 1903, ii-316.
- Railway coal piers, Construction and operation of. Coal-car handling machinery. 1904, i-*265, 279.
- St. Louis Transit Co.'s coal and ash conveyors at power stations. 1902, i-*272, *299.
- Coal hoisting towers, Steel, Various designs of. By H. G. Tyrrell, 1901, i-*386.
- Coal mine explosions. (See Mine explosions.)
- Coal piers. (See Coal handling.)
- Coal pockets. (See Bins; Coal handling.)
- Coal strike. (See Strikes.)
- Coal testing plant at St. Louis Exhibition. 1904, ii-286.
- Coal tipples. (See Tipples.)
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- Coaline, a fuel stimulant. 1902, ii-394.
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- Coast erosion in England. 1902, i-387.
- Coatings for iron and steel. (See Iron and steel, Coatings; Paint; Pipe coverings.)

* denotes an illustrated article. † denotes an inset sheet.

Cofferdams:

- Calking, by the freezing process. Trial in St. Louis, Mo. 1904, i-127.
 Cambridge, Mass. Construction of bridge pier foundations. By S. E. Thompson, 1901, ii-*283.
 Charleston Navy Yard. Failure of cofferdam at entrance of new dry dock. 1900, i-337.
 Chicago pumping station. 1903, ii-*546.
 Crib cofferdam at Spier Falls, N. Y. Dam of Hudson River Water-Power Co. 1903, i-*552.
 Proposed cofferdam for raising the battleship "Maine," in Havana harbor. 1904, ii-*520.
 Repairing a leaking cofferdam at Leech Lake storage reservoir, Minn. By W. C. Weeks, 1901, ii-*187.
 Steel dam at St. Louis, Mo., for construction of power station foundations. 1902, ii-373.

Coke:

- Manufacture from compressed slack. Process outlined by J. H. Darby. 1902, ii-385.
 Retort oven coke for foundry use. By W. J. Keep, 1903, ii-54.
 Specifications for foundry coke, by J. I. Case Threshing Machine Co. 1902, ii-185.
 (See also Locomotives, Fuel.)

Coke ovens:

- By-product ovens of the United Coke & Gas Co. 1902, i-345.
 By-product coke ovens in the United States. Otto Hoffman process. By C. G. Atwater, 1902, ii-331.
 Coking in bee-hive ovens with reference to yield. By Charles Catlett, 1903, i-53.
 Concrete as a lining for ovens. By C. H. Hoyt, 1904, i-65, 107.
 Milwaukee, Wis., plant. Semet-Solvay type of oven. 1904, i-375.
 Record of monthly efficiency, Form for. By Charles Catlett, 1903, i-54.

Cold storage plants:

- Municipal plant at Wolverhampton, England. 1902, ii-359.
 Southampton Docks plant, England. 1903, ii-69.

Cold working sheet metal in dies. By J. D. Riggs, 1902, i-*473.**Columbus, Ohio, Municipal improvements at, and the 1905 convention of the League of American Municipalities.** By R. H. Jeffrey, 1904, ii-199.**Column bases, Concrete, Design of, for freight and passenger sheds.** By Leopold Mensch, 1900, i-*79.**Column footing, Steel-concrete, with rolled corrugated bars.** St. Louis Expanded Metal Co. 1902, i-*273.**Columns:**

- Box columns. By Henry Szlapka, Charles Worthington, J. S. Sewell, 1902, ii-147, 192, *334, 339.
 Calculating columns under eccentric loads. By C. L. Noble and others. 1902, ii-238, 293, 340.
 Cast iron columns:
 Cracking of column due to frozen water. By W. R. Kales, 1903, i-*369.
 Experience with, in two English spinning mill fires. 1903, i-*21.
 Concrete. Formula for designing hooped columns. By S. D. Bleich, 1903, i-303.

Concrete-steel:

- Column without patented features, Design for. By C. H. Marquess, 1904, ii-*154.
 Danger from concrete-filled steel. Letter from New York Fire Insurance Exchange. By Stowe Phelps, H. E. Hess, 1903, i-79.
 Government Printing Office at Washington, D. C. By J. S. Sewell, 1902, ii-*334, 337, 380, 450.
 Ingalls Building, Cincinnati. 1903, ii-*93.

"1900, ii—112" means "Year, 1900, second volume, page 112."

Columns:

Concrete-steel: (Continued.)

Reinforcing an old building, Louisville Lighting Co. By K. O. Guthrie, 1903, ii-*549.

(See also Bins, Concrete-steel.)

Design of columns for freight and passenger sheds exposed to wind. By Lightner Henderson, Leopold Mensch, 1900, i-*79, 211; 1902, i-312.

Diagram for straight line compression formulas. By O. W. Childs, 1900, i-*57, 114, 161.

Diagram for unit stresses in steel columns based on the American Bridge Co.'s column formula. By H. M. Knapp, 1902, ii-502.

Diagram showing safe load on columns according to New York building code. By A. S. Berquist, 1900, i-242.

Diagrams for calculating safe load on cast iron columns according to the New York Building Code of Oct. 10, 1899. By A. S. Berquist, 1901, ii-99.

Granite columns for St. John's Cathedral, New York City. Production and transportation. Raising the 90-ton columns into place. 1903, ii-*491; 1904, ii-*183.

I-columns preferable to box columns for framework of high buildings. By Charles Worthington, 1902, ii-339.

Lattice-bar columns, Stresses in. 1904, ii-593.

Phoenix columns, Experience with. By Henry Szlapka, 1902, ii-192.

Spliced joints in the columns of steel-frame buildings. By J. S. Sewell, 1902, ii-544.

Stiffeners for columns, Practice of beveling. By J. L. Hall, 1903, i-*302.

Timber columns, Composite. By H. P. Gillette, 1901, i-439.

Combustion, New process of. "Hot Air," title of pamphlet published by the Coal Saving & Heating Co. The Schlicht process again. By E. C. Hovey, 1903, ii-162, 225.

Commerce:

Great Lakes, Development of commerce of. 1901, i-32; By Alfred Noble, 1903, i-532.

Growth of New York City's foreign commerce, 1903, ii-223.

Growth of trade with Canada and Mexico. 1904, i-128.

Manufactures, Statistics of. 1900, i-89; 1904, i-225.

Swedish Government statistics. 1900, i-392.

Tientsin, China. Trade of Tientsin and the control of the Peiho River. 1900, ii-185.

(See also Export trade.)

Commerce Commission Report on the commerce of the Port of New York. 1900, i-76.

Commercial education:

Columbia University. 1900, i-297.

Discussion at American Economic Association. 1901, i-40.

Is there a place for a profession in commerce? By H. S. Pritchett, 1901, i-343.

Commercial engineer. By M. S. Ketchum, 1901, i-26.

Compass, Vertical-sighting. 1902, i-256.

Compressed air:

Advantages of, over steam, on contract work. 1903, i-500.

Increasing efficiency of compressed air. 1903, i-193.

Compressed air hauling in a Pennsylvania mine, Cost of. 1902, i-95.

Compressed air jets, Problem in the efficient utilization of. Experience in the use of compressed air ejectors. By Edmund Hoxie, 1904, i-401, 518.

Compressed air motors:

Reversible, Helwig Mfg. Co. 1901, i-*214.

Testing apparatus and methods. C., B. & Q. R. R., Aurora, Ill. By M. H. Wickhorst, 1903, ii-*529.

(See also Locomotives, Compressed air.)

* denotes an illustrated article. † denotes an inset sheet.

Compressed air plants:

- Bisbee West Mine, Arizona. Test of plant. 1903, i-193.
 Cleveland Stone Co., in Gray Canon Quarry. Details of plant, of operation and cost. By L. I. Wightman, 1904, ii-*2, 8.
 Cost of operation compared with that of steam plants. Cleveland Stone Co. By L. I. Wightman, 1904, ii-5, 8.
 Design of plants. Practical hints by O. & C. Co., Chicago. 1900, i-191.
 Wachusett dam. Contractor's plant. Details of plant and its operation. Record of 32 months. 1903, ii-*467.
 (See also Air compressors; Caisson disease.)

Concrete:

- Advantages of, as compared with rubble masonry. By Walter Seely, A. C. Gildersleeve, C. A. Fowler. 1901, ii-74, 106, 158.
 Attack on concrete floor construction by the "Inland Architect." Concrete compared with hollow tile. 1903, i-430.
 Black veins in molded concrete resembling cracks. 1902, i-158.
 Boulder concrete, Use of, for thin walls. By H. G. Hammon, 1904, i-41.
 Broken stone vs. gravel concrete, Relative strength of. By I. O. Baker, W. B. Pine, E. M. Smith, 1900, i-78, 114.
 Cast-stone, called 'Litholite'. 1902, i-355.
 Cement in concrete, Calculating percentage of. By S. P. Brown, W. M. Smith, A. J. Wiley, W. H. Cushman, 1904, ii-181, 243.
 Cinder concrete. Tests by W. H. Henby. Compared with stone concrete. 1900, ii-408; 1901, i-12.
 Comparison of natural cement and Portland cement. By O. L. Gearheart, 1904, i-113.
 Concrete and rubble masonry discussed by J. F. Montgomery. 1902, ii-385.
 Concrete vs. stone masonry. By J. W. Stadly, 1904, ii-365.
 Cost of concrete:
 Estimating. By H. P. Gillette, 1901, ii-422, 456.
 Plainwell, Mich., bridge. By P. A. Courtwright, 1904, i-456.
 Reservoir lining at Forbes Hill, Quincy, Mass. By C. M. Saville, 1902, i-219.
 Crusade against concrete as a fireproof material. 1903, ii-292.
 Crusher screenings, Rejection of. 1903, ii-Cons. News Sup. Oct. 8.
 Crushing strength, Variation of, with the size of the test cube. Investigation at Royal Testing Laboratory at Berlin. 1904, ii-7.
 Deterioration of, in coke oven foundations. By C. H. Hoyt, 1904, i-65, 107.
 Discussion at meeting of American Railway Engineering and Maintenance of Way Association. Comparison with other kinds of masonry. 1901, i-206, 214.
 Dust from stone crushers instead of sand, at Jerome Park reservoir. By L. H. Ireland, 1903, ii-454, 504.
 Efflorescence on concrete. How can it be prevented? 1904, ii-575.
 Expansion, Coefficient of. Tests of concrete bars at Purdue University. Plan of laboratory, testing apparatus and results of tests. By W. D. Pence, 1901, ii-*380.

Facing concrete:

- Illinois Central R. R. specifications. 1900, ii-380.
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 Freezing weather, Concrete laid in. Test of cinder concrete of Roebling Construction Co. in Chicago. 1901, i-283.
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 Joining concrete work left overnight. Specifications for New York State road work. By D. C. Jackson, 1903, ii-185.
 Labor, Hour's time of, required to make one cubic yard of concrete for Buffalo breakwater. By Emile Low, 1902, ii-184.
 "1900, ii-112" means "Year, 1900, second volume, page 112."

Concrete: (Continued.)

- Leaks in concrete, Stoppage of, with linseed oil and with asphaltum and oil. United States Government fortification work. By E. W. Van C. Lucas, W. T. Rossell, Spencer Crosby, 1903, i-306.
- Loam and clay in sand for concrete. Tests by the C., M. & St. P. Ry. By G. J. Griesenauer, 1904, i-413.
- Manure as covering for concrete in freezing weather. By L. D. Cönkling, Ernest McCullough, John Algie, 1903, i-11, 104, 126, 127, 175.
- Mica in concrete. By F. N. Fowler, Jr., 1903, ii-246.
- Permeability of concrete. Is it possible to make concrete which shall be impervious to water? 1903, i-541.
- Permeability of concrete under high water pressures. Experiments by McIntyre and True of the Thayer School. Details of apparatus and results of tests. By J. B. McIntyre and A. L. True, 1902, i-*517.
- Pier superstructure at Duluth harbor, Minn., ship canal entrance. Concrete mixing, molding and laying of blocks. 1900, ii-†56.
- Placing concrete:
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- Laying in freezing weather at Chaudiere Falls, P. Q. 1903, i-402, 408.
- Laying in freezing weather. Use of "Calcidum," a liquid. 1903, i-397.
- Record in laying, Denver, Colo. By W. W. Follett, 1901, ii-490.
- Placing under water:
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- Dry dock foundation laid from floating caisson at Kiel, Germany. 1901, ii-*275.
- Poor method of placing. 1900, i-26.
- Pouring on grout a poor way to make concrete. By W. G. Kirkpatrick, 1902, i-90.
- Precautions needed in concrete construction. Skilled labor should be employed. 1903, i-324.
- Pressure of green concrete against the forms. By G. M. Bacon, 1904, i-542.
- Proportioning concrete:
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- Formulas for computing the cement required for concrete. By R. E. Horton, H. P. Gillette, 1902, i-438, 482.
- Measuring cement for concrete work on Aurora, Elgin & Chicago Ry. 1902, ii-285.
- Proportions and weights of different aggregates used in making concrete for Buffalo breakwater. By Emile Low, 1902, ii-182.
- Proportions of concrete mixtures. 1904, i-111.
- Proportions of materials required to make different classes of concrete for Connecticut Avenue bridge, Washington, D. C. By W. J. Douglas, 1904, i-226.
- Proportions of sand and cement. Estimating cost. By H. P. Gillette, 1901, ii-422, 456.
- Proportions of sand and cement. Experience on the Chicago Drainage Canal works and on the Chicago & Alton Ry. By L. K. Sherman, H. P. Boardman, 1902, i-31, 32.
- Quality and consistency of concrete for concrete-steel work. 1904, i-541.
- Railway structures, Use in. Advantages. Mixing and mixers. Defects. Facing with concrete. Laying concrete. 1901, ii-104; 1902, i-98.
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- Rubble concrete for dam of Atlanta Water & Electric Power Co. 1904, ii-*15.

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Washington, D. C., at Rock Creek culvert, Massachusetts Avenue. By W. J. Douglas, 1902, ii-536.

Screenings and sand for sidewalk concrete. Objections to screening in Chicago. Diagram showing results of tests. By A. S. Cooper, 1904, i-413, 470; By G. J. Griesenauer, 1904, ii-92.

Shrinkage of concrete. Prevention of cracks in the ashlar facing of a concrete wall. By P. C. Hains, W. F. Smith, H. J. Livingston, 1904, ii-447, 505, 546.

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Aurora, Elgin & Chicago Ry. Measurement of cement, consistency of concrete, etc. 1902, ii-285.

Criticisms. 1903, ii-Cons. News Sup., July 30.

Hudson River tunnel work. 1903, ii-337.

Illinois Central R. R. Concrete-steel bridges and culverts. 1901, ii-44.

Report at American Railway Engineering and Maintenance of Way Association. 1902, i-246; 1903, i-274, 284.

Reservoir lining, Aurora, Ill. 1902, i-423.

United States Geological Survey, for drainage canal in Arizona. 1904, i-Cons. News Sup., Jan. 7.

Stone, Tests of, by W. H. Henby. Tests of cinder concrete. 1900, ii-408; 1901, i-12.

Strength and cost of concrete of various compositions. Concrete foundations and cement filler for brick pavements. By O. L. Gearheart, 1904, i-113.

Strength of concrete with different per cent. of voids filled. Series of experiments. By W. A. Hawley and B. F. Krahle, 1900, i-375.

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Manhattan Ry. Co.'s power station, New York. Crushing strength, using selected and unselected stone. By T. S. Clark, A. A. Riffle, 1902, ii-67, 114, 130.

Tests of the tensile and compressive strength of concrete with determinations of the modulus of elasticity, by W. H. Henby. 1900, ii-408; 1901, i-12.

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"Transverse working stress." 1904, ii-93.

United States Government fortification work. Notes from report of the Chief of Engineers, 1902. 1903, i-306.

"1900, ii-112" means "Year, 1900, second volume, page 112."

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Water in concrete:

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Experiments with wet and dry concrete by Chic., Mil. & St. Paul Ry.

By Irving Hitz, O. O. McReynolds, 1901, i-*240, *322.

Notes of experience. By F. A. Mahan, 1902, ii-51.

Proportion of water. Table showing effect of proportion of gaging water on cement mortar. By Clarence Coleman, 1903, ii-187.

Relative strength of wet and dry concrete. By J. W. Sussex, E. R. Frink, 1903, ii-67, 100, 123.

Strength of concrete as affected by different percentages of water. By T. L. Doyle and E. R. Justice, 1903, ii-97, 100.

Waterproofing concrete. U. S. Government fortification work. Notes from report of the Chief of Engineers. By G. W. Goethals, P. C. Hains, E. W. Van C. Lucas, W. T. Rossell, Spencer Crosby, W. C. Langfitt, 1903, i-*306.

Water-tight concrete, Making. Review of what has been done. Possibilities of making concrete impermeable. By M. Childs, 1904, i-469, 518.

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Tests of building blocks manufactured by Iowa factories. Tests made at Iowa State College. By A. Marston, 1904, i-387.

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Barossa dam, South Australia. Apparatus used in weighing concrete ingredients. By A. A. Moncrieff, 1904, i-*324.

Buffalo breakwater construction. Floating plant. Costs. By T. W. Symons, 1902, i-*429, *430; By Emile Low, 1903, ii-*312.

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Classification of machines. By Clarence Coleman, 1903, ii-*187.

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- Mixing and depositing machine for street paving foundations. 1902, i-*266.
- Train for making and depositing concrete, Chic. & West. Ind. R. R. Mixing and distributing plant for street railway work. 1901, i-*149.
- Duluth harbor, Minn. Pier superstructure of ship canal entrance. 1900, ii-†56.
- Efficiency of various machines. By Clarence Coleman, Edward Cunningham, 1903, ii-*186, 233, 318.
- Galveston sea-wall. Mixing and handling machines. 1903, i-*55.
- Hand mixing and use of gravity mixer in England. By Harold Berridge, 1904, i-82.
- Hand work and machine work. Cost of mixing. By O. K. Morgan, H. P. Boardman, C. H. Umstead, L. L. Wheeler, E. S. Gould, Ernest McCullough, 1904, i-39, 82, 107.
- Hand work on a single board 25 feet long. Concrete steel arch over Yellowstone River. By H. M. Chittenden, 1904, i-*26, 36.
- Illinois Central R. R., Big Muddy bridge. By H. W. Parkhurst, 1903, ii-427; 1904, i-111.
- Illinois & Miss. canal. Methods and cost of monolithic concrete work. By L. L. Wheeler, 1904, i-*40.
- Inefficiency of "company work". 1903, ii-Cons. News Sup., Sept. 3.
- McKelvey continuous mixer at the Plainwell, Mich., bridge. By P. A. Courtright, 1904, i-*456.
- Measuring concrete materials. Device for, and for feeding from hoppers into mixers. 1903, ii-304.
- Memphis, Tenn., Electric conduit construction in. By F. G. Proutt, 1904, i-*367.
- Miscampbell rotary mixer. 1903, i-*433.
- New Orleans drainage canal construction. Mixer, material bins and dumping car. By L. W. Brown, 1900, ii-†86.
- New York Gas & Electric Light, Heat & Power Co., 38th St. and East River. Fed by belt conveyor. 1900, i-417.
- New York rapid transit railway tunnel. 1902, ii-*204, 480.
- Notes. By J. H. Harlow, Ernest McCullough, E. S. Gould, H. G. Hammon, 1903, ii-13, 521, 569.
- Pitts., Carnegie & West. R. R. Cost of making concrete for culverts. 1903, i-446.
- Portable mixers:
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 - Plant for street work. Drake mixer and conveyors and electric motive power. 1901, i-*150.
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- Rotary mixers:
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- Santa Ana River viaduct, Cal. By A. C. Ostrom, 1903, ii-*355.
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- Street railway work at Scranton, Pa. 1901, ii-*495.
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- Train for making and depositing concrete for retaining walls. Chic. & West. Ind. R. R. Cars of stone, sand and cement. Drake mixer. "1900, ii—112" means "Year, 1900, second volume, page 112."

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Electric condensers. Tests by C. P. Steinmetz. 1901, ii-27.

Ljungstrom condenser as applied to marine engines. By William Cross, 1903, i-*427.

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Notes on the operation of condensers and condensing engines. By Alexander Dow, 1902, i-*477.

Review of book by F. J. Weiss, 1902, i-373.

Steam turbine condensers at Atlantic Mills, Providence, R. I. 1904, ii-540.

Surface condenser and "towerless cooling tower" combined. Cosmopolitan Power Co. Test at builders' shops by R. W. Hunt & Co. 1902, ii-*546.

Water cooling system at air compressor plant of Cleveland Stone Co. Use of trays broken into riffles. By L. I. Wightman, 1904, ii-3, 8.

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Concrete and expanded metal at Jersey City, N. J., water supply. Experimental test, conduit loaded with rails. By R. Godfrey, 1900, ii-*142.

* denotes an illustrated article. † denotes an inset sheet.

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- New York City electric conduits, Costs of. 1903, i-252.
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- Connecting rod end, Hunt design. By C. W. Hunt, 1901, i-*395.
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- Should an employee bid upon work for an employer? By F. P. Noble, 1903, i-548.
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- Bridge letting at Plattsmouth, Neb. Misleading information. 1900, ii-430.
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- Duties of engineers in enforcing contracts. By A. J. Himes, 1902, ii-45.
- Elements of time in contracts. 1901, i-88.
- Engineers, contractors and specifications. Price contractors charge for carrying risk. Duty of the engineer toward contractors. United States Government Dry Dock. Discussion at American Society Civil Engineers. Abstract of L. Y. Schermerhorn's paper. By L. Y. Schermerhorn, H. P. Gillette, Willis Whited, 1902, ii-213, 237, 238, 264, 287, 403; By W. W. Amburn, J. C. Trautwine, Jr., W. D. Taylor, 1903, i-146, 150, 216.
- Exchange of ideas among contractors. 1903, ii-Cons. News Sup. Aug. 20.
- Experience with contracts and contractors. By E. T. Abbott, 1903, i-302.
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- "1900, ii-112" means "Year, 1900, second volume, page 112."

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- One-sided contracts breed one-sided contractors. 1903, ii-Cons. News Sup. Nov. 26.
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- "Servant" in the eyes of the law. 1904, i-Cons. News Sup. Jan. 7.
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- Time required for completion of a contract, Objections to asking bidder to state. 1904, ii-423.
- Timing contract work with the minute hand, Economic necessity of. 1904, i-Cons. News Sup. May 5.
- Water filtration plant, Wilmington, Del. Litigation between city and U. S. Sand Filtration Co. Objectionable features of contract. 1903, ii-474, 479, 501.
- Controllers, Electric railway. Thompson invention. Trial on Boston Elevated R. R. 1900, i-391.
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- Belt conveyor in coal pocket tunnel at Louisburg, Cape Breton. 1902, ii-*429.
- Chain-belt conveyors for wood-working plants. John Schroeder Lumber Co., Milwaukee, Wis. 1901, ii-*86, 123.
- Cupola slag conveyor at Sharpsville, Pa. 1903, i-551.
- Edison Portland cement plant. By J. M. Dodge, T. A. Edison, 1904, i-62.
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Copper sulphate treatment of water. (See Water purification.)

Core wall and core plate. 1903, ii-Eng. Lit. Sup. Nov. 12.

Corporation law, National, for companies engaged in interstate commerce. Northern Securities Case. 1903, i-346, 388.

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Corrosion:

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Cost keeping on contract work. 1904, i-Cons. News Sup. Jan. 21, 28; By Samuel Young, 1904, ii-525.

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Development of shipyard crane service. Types of revolving cranes. Types of jib cranes. Details of Fore River crane. Power equipment, speeds and work done by various cranes. By H. P. Jones, 1901, ii-*402.

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Traveling crane. By A. D. Williams, 1900, ii-244.

Locomotive and crane. Bullock Electric Mfg. Co. 1901, i-*353.

Newburg Reduction Works, Cleveland, Ohio. Traveling crane. 1900, i-*358.

150-ton cantilever crane, Kiel, Germany, at Krupp Germania wharf. 1900, ii-*90.

Pillar cranes for handling cupola charges, Allis-Chalmers Co. 1903, ii-*99.

Tests of power required to drive traveling cranes. By F. R. Jones, 1903, ii-405.

Traveling crane with transfer carriage. Allis-Chalmers Co., Milwaukee. 1903, i-*407.

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Floating crane, 80-ton, for use on Santos Harbor Works. 1901, ii-113.

Folding gantry crane, 30-ton, Ches. & Ohio Ry. wharves, Newport News, Va. 1901, ii-*208.

Freight house crane, Traveling, over roadway and depressed tracks, Phil. & Read. R. R., at Philadelphia. By E. E. R. Tratman, 1900, ii-*376.

Gantry crane, 50-ton, with double cantilever bridge. Vermont Marble Co., Rutland, Vt., 1903, ii-*508.

Kiel, Germany. Revolving ship crane set on a pier. 1902, ii-89.

Locomotive cranes:

Electric, at Manchester Ship Canal. 1903, i-245.

New York rapid transit work, Section VIII. 1903, i-*20.

Special grab bucket for handling iron ore. By C. H. Wright, 1904, i-*434.

Thirty-ton crane for Lake Superior Power Co. 1902, ii-*422.

Overhead cranes, Lake Shore & Mich. South. Ry. 1902, ii-*524.

Portable pneumatic revolving cranes. Garry Iron & Steel Co. 1903, ii-*87.

Traveling cantilever crane, New York Navy Yard, in erecting battleship "Connecticut." 1902, ii-121.

Traveling jib crane for foundry. Worthington hydraulic works. 1903, ii-*585.

Wrecking crane on Southern Ry. 50-ton steam crane. 1901, ii-*167.

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Cremation of human bodies at Hull, England. Municipal crematory opened Jan. 2, 1901. 1901, i-57.

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Crib, Intake. Chicago water supply tunnels. 1900, ii-310.

Cribwork wharf, Concrete steel, Depot Harbor, Ontario. Specifications. 1904, i-*489.

Cripple Creek Mining District. Notes by an engineer. 1901, ii-475; 1902, i-12.

Croes, J. James R. 1901, i-†42.

Cross-sectioners, Tunnel. By C. F. Sproul, E. E. Young, 1901, i-*200, *252, *450

Cross-sections, Method of calculating area of. By V. A. Kauffman, 1904, ii-*576.

* denotes an illustrated article. † denotes an inset sheet.

Crowns for street pavements, Standard, Omaha, Neb. Table and diagram. 1902, ii-420.

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Illinois Central R. R. Specifications for concrete. 1901, ii-†43.

Jordan Narrows, Utah, on Rio Grande Western Ry. By W. P. Hardesty, 1903, i-*495.

Kalamazoo, Mich., for stream diversion. By G. S. Pierson, 1903, i-*163.

Mobile, Ala., Construction. By J. N. Hazlehurst, 1902, ii-*95.

N. Y. C. & H. R. R. Methods of surfacing concrete. Water, sand and stone heater. By G. W. Lee, 1903, i-*246

Concrete-steel slab culverts, Directions for making. (From Bulletin of New York State Engineer.) 1904, ii-*581.

Design of arch culverts. By D. B. Luten, 1901, i-*435.

Drainage, Mississippi levee system. 1904, ii-*372.

Handling material for rebuilding a long railway culvert, Western & Atlantic R. R. 1902, ii-*136.

Inspection of culverts, Methods of making annual. 1903, ii-394.

Leamington Cut-Off, Oregon Short Line R. R.; Western Utah. Concrete culverts. Iron pipe culverts. By W. P. Hardesty, 1903, ii-*252.

Masonry box culvert for New York State highways. Use of reinforced concrete cover-block. 1903, ii-*170.

Periyar dam, India. Waste culvert through main dam. Sluice-gate details. 1901, ii-*301.

River culverts, Soulanges canal, Canada. Three rivers pass under canal. By C. R. Coutlée, 1901, i-*274.

Cupolas:

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Metallurgy of the cupola. By H. E. Field, 1902, ii-46.

Curb, Ballast, for bridge abutments. 1903, ii-*74.

Current metering:

Experiments with Pitot tubes. Form and velocity of jets. By J. E. Boyd and Horace Judd, 1904, i-*318.

Price meter, Information relating to. 1903, i-Eng. Lit. Sup. Feb. 19.

Ratings and observations by United States Irrigation Investigations Department, Cheyenne, Wyo. Report by C. T. Johnston. 1903, i-158.

Current motors. Utilization of the power of rivers. By Sylvester Stewart, 1903, i-234, 237.

Curve projector and scale for railway work devised by C. H. Quimby, Jr. 1902, i-*500.

Curve tracing instrument. By R. B. Owens, 1902, ii-5.

Curves:

Connecting two curves with a tangent. By C. W. Baldrige, B. C. Yates, 1902, ii-382, 524; By H. A. Wolcott, 1903, i-36, 152.

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Flange pressures on two-truck cars. By G. Lindenthal, 1904, ii-261, *267, *449.

Grade compensation for curvature on South Australian railways. Experiments with heavy ore trains. By A. B. Moncrieff. 1902, i-*505.

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- Holbrook's spiral curves. By E. Holbrook, 1901, i-429; By W. C. Armstrong, W. H. Sadler, 1901, ii-*107.
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- Measuring degree of curve in track. 1901, ii-75, 123.
- Middle ordinates in inches for 20 and 25 meter chords. By H. de B. Forbes, 1901, i-121.
- Parabolic curves, Simple method of constructing. By Henry Szlapka, 1903, ii-*204; By H. G. Loeffler, E. B. Escott, F. T. Daniels, 1904, i-*63, *283, *470, *522.
- Plotting railway curves. New device by Henry Q. Swenson. 1901, i-*249.
- Plotting reversed curves. By E. N. Layfield, Noah Cummings, E. E. Woodman, 1902, i-*333, *438, 481.
- Problems in laying out curves. By Arnold Emeh, 1903, ii-*601; By G. H. Tinker, S. N. Dougherty, 1904, i-228.
- Relining railway curves:
 Chic., Mil. & St. Paul Ry. By R. W. Willis, L. E. Ashbaugh, B. R. Leffler, A. L. Grandy, 1902, i-113, 134, 174, 232, 295.
- Field practice of. By H. C. Ives, 1901, ii-486.
- Rules for curve compensation in Webb's Railroad Construction. 1903, ii-Eng. Lit. Sup. Dec. 10.
- Slide rule computations for laying out curves. By Frank Cooper, H. T. Stiff, 1902, i-147, 214.
- Spiral curves, Suggestions for a more uniform practice in fixing the lengths of. By E. W. Hyde, Jr., W. D. Taylor, 1902, i-308, 460.
- Spiral curves in railway location, Some common objections to. By H. E. Abbott, 1903, i-236.
- Superelevation of rail on curves. Inaccuracy in some engineering approximations. By W. D. Taylor, J. P. Brooks, W. P. Watson, A. M. Haynes, 1904, i-150, 283, 589.
- Train resistance on curves. By L. B. Merriam, J. L. Campbell, 1901, ii-40, 74, 159.
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- Turnout curves. By A. M. Haynes, 1904, i-589; By C. M. Kurtz, R. W. Stewart, 1904, ii-43, *177, *221, *242.

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- Arched concrete, Barossa, South Australia. By A. B. Moncrieff, 1904, i-*321, 328; By Luther Wagoner, A. B. Moncrieff, 1904, ii-92.
- Assouan, Nile River. 1901, i-317; By W. Willcocks, 1901, ii-*221; 1902, i-372; By C. T. Johnston, 1902, ii-*106.
- Atlanta Water & Electric Power Co. Rubble concrete dam. Percentage of cement in mortar, concrete and masonry. By A. J. Wiley, W. H. Cushman, 1904, ii-*15, 181.

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Austin, Texas:

- Failure, April 7, 1900. Special reports. Coefficient of friction in dam design. Stresses due to impact. By T. U. Taylor, 1900, i-*244, *250, *274, *290, *308, 385, *412, *428; 1900, ii-64; By H. P. Gillette, 1901, i-*392; By McCarty & Son, T. U. Taylor, H. P. Gillette, 1901, ii-160, 218.
- Municipal ownership. Is the trouble at the dam an argument against municipal ownership? By R. S. Hale, 1900, i-212, 259.
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- Silting-up of Lake McDonald and the leak of the dam. By T. U. Taylor, 1900, i-128, *135, 161, *179, *212, 259, *410.
- Soundings and measurements at the break in the dam. By T. U. Taylor, 1900, i-*412, 1900, ii-*390.
- Backwater from dams, Effect of, on meadow lands. By E. G. Harris, W. D. Taylor, G. E. Ladshaw, 1902, ii-192, *316.
- Barossa, South Australia. Concrete arch. Temperature changes. By A. B. Moncrieff, 1904, i-*321, 328; By Luther Wagoner, A. B. Moncrieff, 1904, ii-92.
- Barrett, Southern California. Rubble masonry. 1904, i-*335.
- Belubula, New South Wales. Hollow dam of brick with concrete foundation. 1903, ii-500.
- Betwa irrigation dam, India. Automatic drop shutters. By H. M. Wilson, 1903, i-*494.
- Bohio dam across Chagres River, on Panama canal. Designs by New French Co., Isthmian Canal Commission and by G. S. Morison. Plan for constructing dams at great depths in water-bearing material. Tunnel scheme. By G. S. Morison, 1902, i-*215; By J. T. Ford, 1902, ii-*377, 380.
- Boonton, N. J. Accident to diver. 1904, i-351, 375, 379.
- California. Notes on Sweetwater, Morena, Barrett and Otay dams and reservoirs. Mountain Water Co.'s dams. By Robert Fletcher. 1901, ii-124; 1904, i-†335.
- Canyon Ferry, Montana, near Helena. Reconstructed timber dam. 1900, i-*266.
- Charles River, Boston. Plans for dam and basin. By J. A. Holmes, 1904, ii-*305, 313.
- Chaudiere Falls, Quebec, Canadian Electric Co. Dam completed Nov. 7, 1900. Concrete masonry. Construction details. 1900, ii-381; 1903, i-*398, 408.
- Chollas Heights, Cal. Earth dam with steel core plate. 1904, i-*335.
- Colorado River. High dams across river proposed by Arthur P. Davis. 1903, i-489.
- Columbus, Ga., in Chattahoochee River. Failure of dam Dec. 29, 1901. By B. H. Hardaway, T. M. Ripley, R. L. Johnson, 1902, i-34, *62, *70, *107, *177, 232.

Concrete:

- Massena, N. Y., St. Lawrence Power Co. 1901, i-†130.
- Rubble concrete dam for Atlanta Water & Electric Power Co. Percentage of cement in mortar concrete and masonry. By A. J. Wiley, W. H. Cushman, 1904, ii-*15, 181.
- Concrete and earth dam for Troy Water supply. By W. G. Raymond, 1904, ii-*301.
- Concrete as a facing for overfall dams. 1901, ii-428.
- Concrete-faced stone dam at St. Paul, Minn., St. Croix Power Co. 1901, i-*426; By C. L. Fitch, Henry Floy, 1901, ii-26.
- Concrete-steel dam, Hollow, at Standish, Me., and at Theresa, N. Y. By H. W. Foster, 1903, ii-*568; by Ambursen & Sayles, 1903, ii-*403.
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Report recommending changes, by Croes, Smith and Sweet. Mr. Fteley's reply to the experts' report. Mr. Sweet's comments on Mr. Fteley's reply. By A. Fteley, Burr Bassell, E. Sweet, 1901, ii-408, *410, *454, 474, 491.

Report by W. R. Hill on proposed changes in the dam, submitted December 4, 1901. 1902, i-44.

Report by W. R. Hill on the bad foundations beneath the core-wall of the earth portions. 1903, i-*438.

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Steel bonds for masonry dams advised. By H. F. Wilson, Jr., Gustav Lindenthal, 1902, i-11, 52.

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Danielson, Conn., Dyer dam. Failure of bulkhead. By E. H. Brownell, 1901, i-*231.

Danville, Ill. Concrete dam. 1904, i-*396.

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Des Moines, Ia. Extension of dam and paving of river bank. By C. B. Burdick, 1904, ii-*436.

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Druid Lake, Baltimore. High earth dam built in 1864. By A. M. Quick, 1902, i-152, *158.

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Earth dams:

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Design of earth dams and reservoir embankments. Use of asphaltum in core walls. By S. B. Russell, 1902, i-153, 214.

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High earth dams of the world. Comparative cross-sections of. 1901, ii-*411, *490.

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New Castle, Pa., Dam tested by flood of Aug. 27, 1903. By G. B. Zahner, 1903, ii-*264.

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East Canyon Creek, Utah. Rock-fill dam with steel core. By W. P. Hardesty, 1902, i-*14.

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Ellsworth, Me. Earth dam with steel core and concrete-steel spillway.

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Elmhurst, Scranton, Pa. Tested by floods. 1902, i-*234.

El Paso, Texas, over Rio Grande River. Dam proposed by the International Commission. 1904, ii-596.

Failures. Classified review of dam and reservoir failures in the United States. By W. R. Hill, 1902, i-506.

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Fort Pitt, Jeanette, Pa. Failure of earth dam. By Willis Whited, 1903, ii-76.

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Kistna River, India. Reclamation and irrigation of the Kistna delta. 1901, ii-†355.

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Lawrence, Mass., Essex Co. Section of masonry dam. 1902, i-*176.

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Masonry dams:

Correct design and stability of high masonry dams. By G. Y. Wisner, 1903, ii-293, 301.

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Notes on the construction of stone dams. By James Mansergh, 1900, ii-387; By Charles Hawksley, 1901, ii-436; By F. A. Mahan, 1902, ii-50.

St. Paul, Minn., St. Croix Power Co. Concrete-faced stone dam. 1901, i-*426. By C. L. Fitch, Henry Floy, 1901, ii-26.

Sections of various masonry dams. By B. H. Hardaway, 1902, i-*176.

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Mine dams at Chapin mine, Michigan. By James MacNaughton, 1901, i-*215.

Moreno, Cal. Rock-fill dam. 1904, i-*335.

New Castle, Pa. Severe flood test of earth dam, Aug. 27, 1903. By G. B. Zahniser, 1903, ii-*264.

Newspaper logic on dam building. 1903, ii-100.

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Norwich, Conn. Rubble concrete. Automatic flashboards. Hydraulic air compressing plant. By H. M. Knight, 1902, i-*470.

Oakford Park, Jeanette, Pa. Failure of earth dam. By Willis Whited, 1903, ii-25, *76.

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- Puyallup River, Puget Sound Power Co. 1904, ii-*273.
- Quackenkill River, Troy, N. Y., water supply. Concrete and earth dam. By W. G. Raymond, 1904, ii-*301.
- Red Bridge, Chicopee River. Section of masonry dam. 1902, i-*176.
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- St. Paul, Minn., St. Croix Power Co. Concrete-faced stone dam. 1901, i-*426; By C. L. Fitch, Henry Floy, 1901, ii-26.
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- Steel bonds for masonry dams. By Gustav Lindenthal, H. F. Wilson, Jr., 1902, i-11, 52.
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- Stresses on dams due to impact. By J. S. Fielding, 1901, ii-158.
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- Water-bearing material, Constructing dams at great depths in. Parallel tunnels as a "water curtain." By J. T. Ford, 1902, ii-*377, 380.
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 - Special stiff-leg derrick used on New York rapid transit subway. 1902, i-*376.
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10-ton stiff-leg derrick with ball and socket block bearing, Terry & Tench. 1904, ii-*252.

Steel derrick car for bridge erection, 30-ton. 1902, i-*208.

Traveling derrick at Raritan River bridge, New Brunswick, N. J. 1903, i-*539.

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Desert regions and the origin of pebble-covered plains. By W. P. Blake, 1903, i-328.

Diagram for unit stresses in steel columns. By H. M. Knapp, 1902, ii-502.

Diagrams for estimating hydraulic machinery. By F. R. Kleinbans, 1903, ii-*362.

Diamonds, Black, of Bahia, Brazil. 1902, ii-159, 169.

Dictionaries, Technical. 1903, i-Eng. Lit. Sup. Jan. 15.

Dies, Cold working sheet metal in. By J. D. Riggs, 1902, i-*473.

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Dinner specification. 1901, ii-430.

Disasters of the world, Great. 1902, i-392.

Disinfectant called Lysol. 1902, ii-149.

Disinfection of water mains with chloride of lime at Maidstone, England. By G. S. Woodhead and W. J. Ware, 1900, i-412.

Distances, Estimating. 1904, ii-350.

Distilling machinery. (See Water distilling plants.)

District of Columbia. Form of government outlined by Major W. M. Black. 1902, ii-77.

Ditching cuts and widening embankments, Cost of. 1904, ii-375.

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Ditching machines:

Experience of Chic. & Northwestern Ry. and Chic., Rock Island & Pacific Ry. Compared with hand labor. Hart machine. Pneumatic machine of American Steel Foundry Co. 1903, ii-362.

Machine for use with work train, Balt. & Ohio Southwestern Ry. Inventor, D. H. Mahoney. 1904, i-*7.

Diving-bell pontoon on the River Elbe. 1902, i-394.

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Docking the battleship "Oregon" at Puget Sound Navy Yard. 1902, i-*206.

Docks:

Del., Lack. & West. R. R. Fire May 29, 1904. 1904, i-540.

Escanaba, Mich. Large ore dock of Chic. & Northwestern Ry. 1903, ii-*102.

Gt. Northern Ry., West Superior, Wis. 40,000-ton capacity ore dock. 1900, ii-†424; 1901, i-11.

Iron ore docks on Lake Superior. By C. H. Wright, 1904, i-*433.

New York City docks, Investigation of, by War Department. Extension of North River pierhead line near 23rd Street proposed. Report by S. Whinery. Report of New York Harbor Line Board. Efforts of municipal authorities. 1903, i-441; 1903, ii-593; 1904, i-176.

Traveling docks carry canal boats, England. 1902, ii-*430.

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Dodge, James Mapes, Biographical sketch of. 1903, i-†90.

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Largest in the world, for Hotel at West Baden, Ind. Method of erection. 1902, ii-*158.

Dominion Coal Co., Louisburg, Cape Breton. Coal shipping pier. 1902, ii-*428.

Dominion Iron & Steel Co. Manufacture of iron and steel at Sydney, Cape Breton. 1900, ii-181, 186, 200; 1901, ii-†59, 169.

* denotes an illustrated article. † denotes an inset sheet.

Doors:

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Freight house and engine house doors. 1904, ii-378.

Hopper door locking and operating device for ore cars, C., M. & St. P. Ry. 1901, i-*456.

Steel rolling doors for freight sheds and roundhouses. Columbus Steel Rolling Shutter Co. 1903, i-*332.

Double longitudes, Calculation of. 1900, i-26.

Douglas, James, Biographical sketch of. 1900, i-46.

Dowd, Charles F., and the system of standard time. 1904, ii-544.

Draft gear. (See Cars, Draft gear.)

Draft of vessels in motion in shallow channels compared with their stationary draft. Observations in New York harbor. Experiments with ship models at Washington, D. C. By H. N. Babcock, D. W. Taylor, 1904, ii-101, 111, *269.

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Draft tubes, Effect of, on turbines. By J. W. Thurso, 1903, i-29.

Drafting machine, "Universal." 1902, i-*395; By John McGeorge, 1903, i-*572.

Drafting methods. Graphical determination of angles in skew structural work. By C. A. P. Turner, 1900, i-107, †126, 146; By C. G. Wrentmore, 1904, i-28, 161.

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Rules governing the employment of draftsman in the United States Navy. 1901, ii-18.

Drainage:

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Dredging for drainage improvement. By E. E. Watts, 1902, i-139.

Government drainage investigation. 1902, ii-64.

Havana. (See Sewerage, Havana.)

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Irrigated lands in the West, Difficulties with. By Ernest McCullough, 1903, ii-158.

Irrigated towns and tile underdrainage as a relief from seepage water. By Elwood Mead, L. G. Carpenter, A. F. Parker, 1902, ii-541; 1903, i-36, 79.

New Jersey. Law passed by Legislature. 1903, i-357.

New Orleans, La.:

Advisory board and its recommendations. 1900, i-401.

Canal construction in St. Louis Street. Concrete mixer. Hayward bucket. Turntable pile driver. By L. W. Brown, 1900, ii-†86.

Controversy over cement specifications. Attacks on Mr. Harrod. Report of Board of Experts. 1902, i-172, 288.

Controversy with Sewerage and Water Board. 1902, i-414.

Merging of sewerage and drainage boards. Protest of people. 1902, ii-1, 325.

Proposed system. Investigation and surveys. By L. W. Brown, 1900, i-*180.

Substitution of cheaper cement. Report of G. G. Earl. 1904, ii-7, 336.

Tile underdrainage as a relief from seepage water due to irrigation. By Elwood Mead, L. G. Carpenter, A. F. Parker, 1902, ii-541; 1903, i-36, 79.

Viaduct structure of the Metropolitan Underground Railway of Paris, Drainage of. 1903, ii-*195.

Drainage areas:

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"1900, ii—112" means "Year, 1900, second volume, page 112."

Drainage areas: (Continued.)

Sudbury River, Run off from 1875-1899. By C. W. Sherman, 1900, i-365.
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Drawing:

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Dictionary of mechanical drawing, Proposed universal. By G. H. Follows, 1904, ii-*29, *351.

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Mechanical drawing in a modern drafting room, Westinghouse Electric & Mfg. Co. By G. H. Follows, 1903, ii-*344.

Outlining title lettering by means of type and finishing the letters in the ordinary way. By J. N. Ambler, 1904, ii-405.

Shading convex and concave surfaces. 1903, ii-*318, *343, 414.

Side-slope lines, Method of drawing. By H. K. Higgins, 1904, i-*330.

Signs, Conventional, for maps of Oswego-Mohawk Ship canal survey. By D. J. Howell, 1900, i-*420.

Signs, Standard proposed, for heating and ventilating systems. 1900, i-*87.

Tracing drawings by the aid of light from beneath. By R. E. Parker, 1904, ii-*595.

Zinc sheets for plane table work. By R. E. Parker, 1904, ii-199.

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Drawing instruments:

Plotting contour lines. Kubala instrument. Home-made instruments. By I. T. Farnham and by A. S. Burgess, 1900, i-211, 307, *410; By C. D. Ward, Horace Andrews, 1900, ii-62, 109; 1903, ii-*57, *101, *143.

Test of tetragons and double triangles. By L. F. Rondinella, 1901, ii-*430.

Drawing office record of work by Indiana Bridge Co. 1902, ii-72.

Drawing office rules. By A. W. Robinson, 1901, i-392.

Drawing rooms:

Equipment of. By John McGeorge 1903, i-*572.

Filing cases for drawings, Steel. 1902, i-*4.

Mechanical drawing in, Westinghouse Electric & Mfg. Co. By G. H. Follows, 1903, ii-341, *344.

Pitts. & Lake Erie R. R., Pittsburg. Chief Engineer's office. Drawing tables. Card index system. Blue print room. By R. P. Forsberg, 1902, i-*2.

Toledo plant of American Bridge Co. By R. G. Manning, 1902, i-*325.

Drawing tables:

Light bracket tables. By John McGeorge, 1903, i-*572.

Pitts. & Lake Erie R. R., at Pittsburg. By R. P. Forsberg, 1902, i-*2.

Toledo plant of American Bridge Co. By R. G. Manning, 1902, i-*325.

Worcester Polytechnic Institute. 1904, ii-*381.

Dredge buckets:

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- Bucyrus 6 cubic-yard dredge for use on Great Lakes. Wire ropes for hoisting. Operation of hoisting engine. 1900, i-*138.
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- Gold dredge, Electrical equipment of. By R. L. Montague, 1903, ii-*64.
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- Comparative short time tests of "Delta," "Epsilon" and "J. Israel Tarte." By A. W. Robinson, 1904, ii-86.
- Hopper dredge "La Puissante" for Suez canal. 1901, i-73.
- "Iota," a self-propelling dredge, for Mississippi River. 1900, i-†355.
- "J. Israel Tarte." By A. W. Robinson, 1902, ii-57, 81; By Emile Low, A. W. Robinson, 1904, ii-*83, 89, 133.
- "King Edward," for work on the Pacific Coast. By A. W. Robinson, 1903, i-*131, *209.
- Massena, N. Y. Dipper dredge with scoop of 6 cubic yards capacity. 1901, i-*130.
- Model of hydraulic dredge by L. Smith & Son, Holland, at Paris Exposition. 1900, i-313.
- New York Harbor, seagoing hopper dredges. 1901, i-†118; 1903, i-*428.
- "Pacific," seagoing dredge, for work in Tacoma harbor. 1903, i-489.
- Port of Portland, Oregon. 30-in. centrifugal suction dredge. 1903, i-†382.
- "Sabine" launched. 1900, ii-381.
- St. Louis settling basins, Dredge for cleaning. By E. E. Wall, 1903, ii-*484.
- South West pass of Mississippi River. Centrifugal pump designed to avoid excessive wear. Experiments showing wear of different materials under action of sand blast. By M. M. Patrick, 1901, ii-145, 169; 1903, ii-*26, 36.
- "Thomas" and "Mills" dredges. By H. N. Babcock, 1901, ii-241; 1903, i-161.
- Yazoo River Diversion Channel dredge. 1903, i-*227.
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- New York harbor work. 1901, i-†118; 1903, i-*428.
- Sand dredge with storage bin and flume for excavating sand and gravel from river bed for concrete for Buffalo breakwater. By Emile Low, 1902, ii-*182.
- Sand-pump dredging at Liverpool. "Brancker" and "G. B. Crow." 1900, i-39.
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- Steam-shovel converted into dredge. Gravel taken from river bed. Choctaw Railway. 1901, i-253.
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- Vacuum orange-peel dredge. Failure, on the Massena canal. 1902, ii-365.
- Volga River, Bates system on. 1900, ii-29.
- "1900, ii-112" means "Year, 1900, second volume, page 112."

Dredging:

Brunswick, Ga. Dynamite used. Report by Capt. C. E. Gillette. Movement of sand on beaches. Observations by Capt. T. H. Rees. Tests by H. H. Bacon in Florida. 1901, i-284, 292, 358; 1903, i-78, 117.

Cost of dredging in the Massena canal. Centrifugal pump dredge, dipper dredge and orange-peel dredge. 1903, ii-365.

Cost of dredging on German ship canal in 1901. 1902, ii-249.

Drainage improvement by dredging. By E. E. Watts, 1902, i-139.

Dynamite work. (See above, Brunswick, Ga.)

Interesting work with vacuum dredge by Empire Dredging Co. Seaboard Air Line Ry. Co., Savannah, Ga. 1902, i-1.

Measuring dredged channels in the improvement of the Delaware and Schuylkill Rivers. Sounding raft. Submerged sweep with row boat. Sweep and derrick scow with diver. 1902, ii-*8.

Measuring dredging quantities "in situ." 1902, i-312, 482; 1902, ii-34.

New York harbor work in Ambrose Channel. Report of H. N. Babcock. 1903, i-161.

New Zealand gold dredging. By Gilbert Winslow, 1904, i-224, 247.

"Ordinary digging," What is? 1904, i-Cons. News Sup. March 24.

Oroville, Cal. Prospecting and valuing dredging ground with a well-driller. By N. B. Knox, 1903, ii-94.

Place measurement and scow measurement, Comparison of. 1904, ii-197. (See also Earthwork.)

Dredging contractors, Association of. 1903, i-488.

Drill-bit and wedge. Plymouth power wedge hole cutter. Ingersoll-Sergeant Drill Co. 1901, ii-*320.

Drill grinding machine, Yankee, Single adjustment. 1900, i-*148.

Drill hole reamer. Cyclone Drilling Machine Co. 1904, ii-*286.

Drilling:

Bed-rock exploration on the Gila River, Arizona, dam sites, with diamond core drills. Cost of operation. By J. B. Lippincott, 1900, i-*34.

Cost of diamond drilling in Natal in 1901, with hand power and with steam power. 1903, i-183, 312.

Cost of diamond drill borings in the Colorado River Valley and at St. Mary's Lake, Montana. Compared with hand labor. By A. P. Davis, 1903, i-395.

Cost of drilling in gold gravel, Oroville, Cal. Prospecting and valuing dredging ground with a well-driller. By N. B. Knox, 1903, ii-94.

Diamond drill work. Experience on the Deep Waterways survey, with statistics of cost. 1903, ii-83.

Hand and power drilling in mine stopes. Wood triangle for drill tripods. Special drill for seamy rock. 1903, i-*215, 277, 279.

Pruszhowski water motor for rock drilling. 1902, ii-157.

Simplon tunnel. Brandt rotary drills. 1900, ii-29, *152; 1903, ii-*175.

Drillings, Standard. Report of Bureau of American Foundry Association. 1900, i-400.

Drills and drilling machines:

Air consumption of rock drills, American and English. Competitive tests. 1904, i-566.

Bit for drilling in earth with steam drills. By C. M. Ayres, 1903, ii-*368.

Black diamonds for diamond drills. 1902, ii-159, 169.

Brandt rotary, on Simplon tunnel work. By C. B. Fox, 1900, ii-29, *152; 1903, ii-*176.

Compressed air operation at Wachusett dam. 1903, ii-*470.

Davis "calyx" core-drill. Various forms of cutting teeth for rotary core-drills. 1901, i-*334.

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Discussion of rock drills. By E. J. Munby, 1903, ii-201, Cons. News Sup. Sept. 3.

Durkee. 1901, ii-*130.

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* denotes an illustrated article. † denotes an inset sheet.

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 Pneumatic rock drill, Chicago-Schmucker. 1901, i-*125.
 Rock drill tests in South Africa. 1904, i-515.
 Swinging drilling machine for bridge and structural work. Niles Tool Works Co. 1902, i-*94.
 Thrust and moment of twist drills, Diagrams of. Device for obtaining diagram. 1904, ii-*539.
 Universal ratchet drill. 1901, ii-*55.
 Water Leyner rock drill in South African gold mines. 1903, i-204.
 Well-drillers used for boring blasting holes. 1903, ii-274, Cons. News Sup. Sept. 24; 1904, i-587.

Drop hammers:

- Brett hammer with direct steam lift. By E. W. Merrill, Jr., 1903, i-*24.
 Notes on the evolution of the drop hammer for die forgings. By E. W. Merrill, Jr., 1903, i-*23.

Drop-testing machine of Master Car Builders' Association at Purdue University. 1904, ii-430.

Dry docks:

- Baltimore, Md. 1902, i-*36.
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- Algiers, La. United States Naval station. 1900, i-†294.
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 Philippine Islands. 1903, i-265; By J. S. Shultz, 1903, ii-*517.
 Port Mahon, Minorca. 1901, ii-55.
 Port of Durban, South Africa. 1902, ii-181.
 Kiel, Germany. Concrete dry-dock subaqueous construction by floating pneumatic caisson. Air valves for regulating the time of passing through an air lock. 1901, ii-*275; 1903, ii-†494, 500; 1904, i-60, *65.
 Kobe, Japan, Kawasaki Dock Yard Co. New graving dock. By Genjiro Yamasaki, 1903, ii-*257.
 Morse Iron Works & Dry Dock Co., Brooklyn. Proposed construction. 1900, i-265.
 New York. Proposed ship yard and dry dock on reclaimed ground between Bedloe's and Ellis Islands. 1901, i-241.
 Newport News, Va. Discussions. 1901, i-476.
 Norfolk, Va. Concrete and granite dock. 1902, ii-105.
 Philippine Islands, Steel floating dock. 1903, i-265; By J. S. Shultz, 1903, ii-*517.
 Portsmouth, N. H. 1901, i-441.
 San Francisco, Cal., at Hunter's Point. Excavation in solid rock and concrete lined. Steel reversible caisson for closing dock. 1900, ii-†276.
 Timber, Lang floating. Built by Tietjen & Lang Co. By W. T. Donnelly, 1901, i-†314.
 Toulon, France. Pneumatic steel caisson foundations. 1900, i-†379.

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Dudley, Charles B., Biographical sketch of. 1904, i-†92.

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- Foundry car. B. F. Sturtevant & Co. 1903, ii-*417.
 Ingolsby car. Tests. 1901, ii-*32; 1902, i-285; 1902, ii-*7.
 Dumping bucket, Automatic. Cornell Machine Co. 1901, i-*171.
 Dumping frame, Automatic, for shafts. Fairbanks, Morse & Co. 1902, i-*477.
 "1900, ii—112" means "Year, 1900, second volume, page 112."

Dumping machines, Coal car. McMyler, Brown and Wellman-Seaver-Morgan. 1904, i-*267.

Dumping wagon, Shadbolt, used on New York rapid transit subway. 1902, i-*376.

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Bacterial studies of dust in Lafayette, Ind., and in New York. By D. B. Luten and Severance Burrage, 1900, ii-*242; 1902, ii-429.

Disease and street dust. 1903, i-76.

Dust-arresting respirators. Prize competition by the Society of Arts. 1903, i-464.

Dust collecting apparatus in boiler rooms. By A. A. Cary, 1900, i-*92.

Dust in blast furnace gases. By Adolphe Greiner, 1901, ii-150.

Dynagraph for wagon traction experiments. By I. O. Baker, 1902, i-*184.

Dynamite:

Beginning of the end of dynamite. Defense of dynamite. By W. A. Battle, W. H. Bolander, G. W. Hughes, 1903, i-79, 128, 197.

Destroying five tons near Pensacola, Florida. "A good way not to destroy dynamite." 1903, i-194.

Dynamite as the means of checking the spread of a conflagration. 1904, i-516.

Prohibiting dynamite for quarrying concrete ballast. 1903, ii-Cons. News Sup. Oct. 15, 22.

Questions concerning dynamite. By C. W. L. Pilkins, John Ryan, 1903, i-279, 326, 391.

Should dynamite be used in cities? 1902, ii-523.

Tests of, with the "Abel block," by A. W. Warwick. Conclusions based upon tests. 1902, ii-428.

Thaw-box, Hot water. By J. H. Harper, 1904, i-*259.

Thawing dynamite. By H. P. Gillette, 1901, ii-197; By S. C. Hulse, 1904, i-130.

Transportation of dynamite. Accident at Sunbury, Pa. By C. L. Patterson, 1903, i-391.

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Melrose, Mass. Box of dynamite hit by street car. 1904, ii-287, 296.

Mount Vernon, N. Y., and Somerville, N. J. 1904, ii-430, 435, 506.

New York rapid transit railway work. 1902, i-92.

Wagon load struck by train at North Branch, Md. 1904, ii-296.

Dynamometers:

Absorption, for locomotive testing plant, Alden. 1904, i-*475.

Lathe-tool, Experiments with. 1904, i-538.

Measuring tractive force on electric or other cars, German invention. 1900, ii-173.

Transmission, for testing electric motors of from 5- to 25-HP. capacity. Details of shaft and spiral spring clutch jaws. By W. E. Goldsborough, 1900, ii-*59.

Water-friction absorption brakes used in tests of steam turbines at Westinghouse Machine Co.'s plant. By J. R. Bibbins, 1904, i-*215.

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Comparative use of prismoidal formula and average end area method of computing earthwork. By O. O. McReynolds, 1901, i-*286.

Computing dredged material in situ. 1902, i-312, 482.

Computation of economic overhaul. By G. H. Tinker, 1901, i-82, 154.

Cost of ditching cuts and widening embankments. 1904, ii-375.

* denotes an illustrated article. † denotes an inset sheet.

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Cost of earthwork in constructing macadam roads. By H. P. Gillette, 1901, ii-51.

Cost of overhaul. 1903, ii-Cons. News Sup., July 2, 16, 23.

Cross-sectioners, Tunnel. By C. F. Sproul, E. E. Young, 1901, i-*200, *252, *450.

Cross-sections, Method of calculating area of. By V. A. Kauffman, 1904, ii-*576.

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"Gumbo" in earthwork classification. By P. E. Green, C. H. Miller, 1904, i-234, 452, 494.

Handling of earth on reservoir work. 1903, ii-Cons. News Sup., Sept. 10, 17, 24, Oct. 1, 15.

Haul, Length of, in specifications. 1904, ii-313.

Haul diagram for computing overhaul and free haul on railways. By F. C. French, 1904, i-101.

Hydraulic excavation for embankments and placer mining, Cost of. 1902, ii-438; 1903, i-11.

Plow test for classification. Diagram. By J. A. Fulton, 1904, i-179.

Rapid calculation. Formulas. Prismoid formula. End area vs. prismoidal formulas. By H. P. Gillette, H. C. Ives, 1900, ii-419, 445; By F. T. Lewis, F. E. Foss, W. H. Boughton, H. P. Gillette, O. O. McReynolds, 1901, i-30, 31, 170, 190, 286; By B. W. Hicks, H. P. Gillette, G. H. Tinker, 1902, i-30, 51, 90.

Shrinkage. (See Embankments, Shrinkage; Slope stake setting.)

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Earthwork tables. Merits and limitations of 12 books. 1903, i-Eng. Lit. Sup. Jan. 15, Feb. 19.

Earthquakes:

Notable. 1902, i-393.

Russian Transcaucasia, Feb. 13, 1902; 1902, i-141, *341.

Economizer, Green, Explosion of, at Stalybridge, England. 1902, ii-*194.

Edison Portland Cement Works. 1902, i-*432; 1903, ii-555, 567.

Education:

Cultural value of engineering education. By F. O. Marvin, 1901, ii-12.

Discussion of engineering education by Society for Promotion of Engineering Education. 1903, ii-34, 36, 44.

Education of machinists, foremen and mechanical engineers. By M. P. Higgins, 1900, i-362.

Efficiency factor in engineering education. By Robert Fletcher, 1902, ii-17.

Engineers, Education of. By William Kent, 1903, ii-348.

Industrial education in America. 1900, ii-33.

Money value of technical training. By J. M. Dodge, 1903, ii-521, 528, 544.

Need of technical high schools in our educational system. By V. C. Alderson, 1902, ii-71.

Progress in engineering education. By W. D. Pence, 1903, i-14; By C. F. Allen, 1904, ii-228.

Railway employees, German school for, at Munich, Germany. 1901, ii-1.

Railway men, Education of, as subordinates for the maintenance of way service. By W. G. Berg, 1900, ii-193.

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Egg shells, Pressure tests of. By A. E. Grey, 1902, ii-325.

Egypt:

Egypt fifty years hence. 1902, i-479.

Railway and engineering work in. 1900, ii-199.

Eight-hour days. (See Labor question.)

Electric arc, Photometry of. Apparatus for the measurement of luminous intensity. Investigation by the National Electric Light Association. By C. P. Matthews, 1900, ii-*89.

"1900, ii-112" means "Year, 1900, second volume, page 112."

- Electric batteries, Standard cells of. Discussion at American Electrochemical Society. 1904, i-349.
- Electric brakes. (See Brakes.)
- Electric burner for opening blast furnace tuyeres. Experience at Cleveland, Ohio. By F. L. Grammer, 1901, ii-346.
- Electric currents:
Cathode ray alternating current wave indicator. By H. J. Ryan, 1903, ii-*189.
Stray return currents. 1903, i-373.
- Electric furnaces:
Closed and continuous working in. Advances made. By E. R. Taylor, 1902, ii-232.
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Gysinge, Sweden. Steel furnace. By F. A. Kjellin, 1904, i-*272.
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- Electric generators:
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Engine-type electric generating sets. Co-operation between engine and generator builders. By H. C. Ebert, 1900, ii-422.
Failure of motors and dynamos; their nature and causes. By A. C. Cormack, 1903, ii-202, 210.
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Niagara Falls Power Co. New plants. By H. W. Buck, 1902, ii-*9.
Operation of alternators by Pelton water-wheel, St. Louis water-works. 1902, i-425.
Parallel operation of alternating current generators. Engine requirements. Specifications of Westinghouse Electric & Manufacturing Co. By E. M. Tingley and H. E. Longwell, 1902, i-498.
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* denotes an illustrated article. † denotes an inset sheet.

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Cost of arc lighting in different systems. Table given. By H. H. Wait, 1900, i-14.

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Baltimore, Md. Preliminary report of Municipal Lighting Commission. 1900, i-192.

Boston Edison Illuminating Co., Atlantic Avenue station. By I. E. Moulthrop and R. E. Curtis, 1902, i-465.

Brookhaven, Miss. Operating expenses and revenues of municipal water and light plant. By Granbery Jackson, 1901, i-434.

Carnegie Library, Pittsburg. Gas engine direct-connected with dynamo. 1900, ii-377.

Chicago:

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Cost of electric street lights in various cities of the United States. By R. L. Johnson, 1903, i-252, 277.

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Detroit, Mich.:

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Jacksonville, Fla. Rates. Report of Board of Trustees. 1902, ii-435.

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"Luminometer" for ascertaining relative candle power of light. 1902, ii-311.

Massachusetts Gas & Electric Light Commission. Reports on state lighting plants. Municipal and private ownership. 1900, i-408.

New Orleans, La. Bids wanted. 1902, i-165.

New York City:

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Report by C. T. Hutchinson giving estimates for electric plant. 1903, i-481.

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 Utah Light & Power Co. Small water power electric transmission plant. Details of wood stave pipe line. By W. P. Hardesty, 1902, i-*302.
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 Warren, Ohio. Reconstruction of water and lighting plant. 1901, ii-*146.
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St. Croix Power Co., St. Paul, Minn. Protection of transmission line. By H. J. Gille, 1902, i-487.

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- Engineering school graduates employed on Commission. 1902, ii-112.
- Extensions of system proposed. Report by W. B. Parsons. Subway extensions. Elevated extensions. Steam railway connections. 1903, i-200; 1904, i-423.
- Four-track tunnel proposed for lower Broadway. By J. W. Reno, 1902, i-*174.
- Franchise granted to Interborough Co. 1903, i-336.
- General description of the work. 1902, i-161.
- Harlem River tunnel. 1903, ii-*289, *308, 545; 1904, ii-*325.
- History of rapid transit enterprises in New York City. 1902, i-*83, 88, *106, 127, *161, *199, *236, *318, *374; 1902, ii-*202, 242, 256, *343, *390, 478; 1903, i-19, *147, *181, *514; 1903, ii-*199, *289, *308, *460; 1904, i-*52.
- Injunction restraining work on Section 4 denied. Abstract of legal opinion. 1902, ii-157.
- Motormen, Physical examination of. 1903, ii-388.
- Moving concrete walls. 1903, i-*515.
- Opening of. Predictions and forerunners of the subway. 1904, ii-74, 403.
- Organization of the working force. 1902, i-162.
- Plan and profile. 1902, i-161.
- Power plant, Notes on. 1901, ii-169, 249; 1903, ii-153.
- Rock slide at 37th Street and Park Avenue. 1902, i-241.
- Sewer diversion. Preparatory work. 1902, i-*199, *236.
- Traffic figures. 1904, ii-508.
- Tunnel sections. 1902, i-*162, *164.
- Ventilation in subway. Dr. Siebert's published statement. 1904, ii-504.
- Vibration from tunnel trains. Experiments to overcome vibration. 1901, i-57.
- Widening a section of tunnel by moving the side walls. 1902, i-*26. (See also Tunnels, East River; Tunnels, Hudson River.)
- Notes on modern railway practice. Direct vs. alternating current motors. By A. H. Armstrong, 1901, ii-358, 366.
- Omaha, Neb. Proposed large power and railway plant. 1901, ii-129.
- Oshkosh & Neenah interurban, Wisconsin. Single track. Overhead construction. Power station. 1900, i-218.
- Overhead construction for alternating current used on Ballston line of Schenectady Ry. Co. 1904, ii-*170, 179.
- Paris Metropolitan Ry.:
 - Construction details of the "North Circle." 1903, ii-*194.
 - Fire in subway line, Aug. 10, 1903. 1903, ii-133, 162, 213, 222.
 - Notes. 1900, i-65.
 - Statistics. 1901, i-211, 385.
 - Underground line. Tunnels, power plant and rolling stock. 1900, ii-392.
- Philadelphia rapid transit system. 1904, ii-*584.
- Return circuit, Best manner of conducting to the power house. By E. G. Connette, 1901, ii-293.
- Rockford & Belvidere Ry. 1901, ii-447.
- Russia, First suburban railway in. 1901, i-425.
- St. Louis intramural, at Exhibition, 1904. Power plants. 1904, ii-*320.
- St. Louis Transit Co.:
 - Central power station. 1902, i-*269.
 - Northern Power Station. 1902, i-297.
 - Notes. 1904, i-*620.
- Seattle-Tacoma line, Washington. 1902, i-141.

"1900, ii—112" means "Year, 1900, second volume, page 112."

Electric railways: (Continued.)

- Single-phase alternating current on the Washington, Baltimore & Annapolis Ry. By B. G. Lamme, 1902, ii-181, 268, 317.
- Single-phase railway, General Electric system of, on the Ballston line of the Schenectady Ry. Co. 1904, ii-*170, 179.
- Single-phase railways, Development of. By W. A. Blanck, 1904, i-322.
- State regulation of electric railways. Discussed by F. G. Ewald of the Illinois Railroad and Warehouse Commission. 1903, i-137.
- Statistics of street and electric railways in the United States for year ending June 30, 1902. 1903, ii-248.
- Storage batteries, Value of, as auxiliaries. By W. E. Harrington, 1901, ii-294.
- Surface contact systems:
- Diatto system. 1901, i-*294.
- Lorain system at Wolverhampton, England. Report on. Line not accepted by town. 1903, i-420, 537; 1903, ii-328.
- Switching by mechanical means, English device for. 1901, i-457.
- Westinghouse system. 1901, i-*293.
- Switzerland. Thun-Berthoud Ry. 1902, i-125.
- Tacoma, Wash. Accident. Car fell from bridge. By A. McL. Hawks, 1900, ii-17, *46.
- Terminal problems of interurban electric railways. Review of paper by I. A. McCormick of Cleveland. 1901, ii-330.

Third rail:

- Aurora, Elgin & Chicago Ry. 1902, ii-114, *282.
- Murphy system in Baltimore tunnel, Balt. & Ohio R. R. 1901, i-113.
- N. Y., N. H. & H. R. R. Experience with system. 1902, ii-113, 251.
- Northeastern Ry., England. 1903, ii-121.
- Potter design for third-rail. Tests of steel for electric conductivity by General Electric Co. By J. A. Capp, 1903, ii-*381.
- Protected rail on Wilkesbarre & Hazleton R. R. 1903, i-243.
- Protected sectional rail. E. W. Farnham, inventor, Chicago. 1904, i-38, *300.
- Public agitation against the third rail system. 1903, ii-*566.
- Third-rail and trolley-wire systems for interurban railways. 1902, ii-113.
- Tokio, Japan. Plans for first railway. 1902, i-1.
- Trolley lines without rails in France and Germany, Report on. 1904, ii-182.
- Underground, Fire precautions for, in Great Britain. 1904, i-611.
- Union Traction Co. of Indiana. Description of line, of rolling stock and power plant. 1902, ii-*395.
- Washington, D. C. Explosions on the conduit railways. 1901, ii-289.
- Washington, Baltimore & Annapolis. Single-phase alternating current railway. By B. G. Lamme, 1902, ii-181, 268, 317.
- Zurich, Switzerland. 1900, ii-412.

Electric shocks:

- Death and injury from. By F. P. Aspinall, A. P. Trotter, 1902, ii-85.
- Death from, at Fulham, London, in the public baths. 1903, i-102, 112.

Electric smelting:

- Canadian Commission reports on. 1904, i-104; 1904, ii-445.
- Discussion by M. Ruthenberg, J. W. Thurso. 1902, ii-230, 260, 383.
- Is it practicable? 1901, i-321; 1901, ii-122, 160; 1902, ii-260, 383.
- Work of A. J. Rossi. Cost of manufacture by blast furnace and electric furnace compared. 1903, i-35, 127, 236.

Electric Vehicle Co., Finances of. 1901, ii-176.

Electric welding. (See Rails, Welded.)

Electric wires:

- Dangers to firemen from electric light and trolley wires. By M. W. Mead, 1901, ii-135.
- Precautions advisable in installing house circuits for alternating current. Deaths in public bath at Fulham, London. 1903, i-102, 112.

* denotes an illustrated article. † denotes an inset sheet.

- Electrical business, Opportunities in. Results of an inquiry among 100 men in Chicago. By G. A. Damon, 1904, i-325.
- Electrical conductivity of commercial copper. By Lawrence Addicks, 1903, ii-*533.
- Electrical history. (From William Stanley's affidavit.) 1902, ii-278.
- Electrical industries, Progress in. By H. L. Doherty, 1900, i-62.
- Electrical laboratory, New York State, Proposed. 1902, i-345.
- Electrician's safety-dress of wire gauze invented by Prof. Artemieff. 1902, ii-225.
- Electricity direct from coal. Patent to Hugo Jone. 1901, ii-33.
- Electrochemical calculations, Unit of quantity of electricity for use in. By A. H. Cowles, 1902, ii-231, 402, 451.
- Electrochemistry. Constant voltage and constant current separations. 1903, i-372.
- Electrodeposition of metals upon a rotating cathode. 1903, i-374.
- Electrodes, Carbon, Testing of. By F. A. J. Fitzgerald, 1902, ii-239.
- Electrograph instrument for picture telegraphy. 1902, i-*354.
- Electrolysis, Stripping brass from iron by. By C. F. Burgess, 1903, ii-265.
- Electrolysis of brine, Concentration changes in. 1903, i-373.
- Electrolysis of pipes:
- Atlantic City, N. J., Prevention ordinance passed by city council. 1902, ii-513.
 - Battle Creek, Mich. Ordinance in force. 1901, i-145.
 - Bayonne, N. J. Survey and report by A. A. Knudson, 1904, ii-*437.
 - Cement and other pipe joints in relation to electrolysis. 1904, ii-524.
 - Current flow in cast-iron and wrought-iron pipe. Tables. By D. H. Maury, 1903, ii-75.
 - Damage by electrolysis and electric railway companies' responsibilities. 1900, ii-180; By D. H. Maury, 1903, ii-75.
 - Dayton, Ohio. Case against the street railway companies. 1901, ii-296; 1902, i-310, 316.
 - Diminished by periodical reversal of current. Experiments at Copenhagen, 1902, ii-349.
 - Electrical resistance of joints of cast iron mains. Tests by Jackson, Knudson and Maury. By D. H. Maury, Jr., 1900, ii-*38, 44.
 - Experimental measures to prevent electrolysis, by Boston Elevated Railway, in 1902. 1903, i-513.
 - Franklin, Ohio. Suit against the Southern Ohio Traction Co. 1901, i-145; 1901, ii-296.
 - Great Britain. Prevention of electrolysis of water and gas pipes. Regulations of British Board of Trade. 1902, ii-273.
 - Hamburg, Germany. Gas pipes and water pipes. 1901, ii-209.
 - Indiana. Bill in legislature. 1901, i-129.
 - Indianapolis, Ind. Court decision as to responsibility for damage to gas mains by electrolysis. Abstract of decision. 1901, i-12.
 - Norfolk, Va. Ordinance for prevention of electrolysis. 1901, ii-185; 1902, i-165, 172.
 - Peoria, Ill. Reply to A. B. Herrick. By D. H. Maury, A. A. Knudson, 1901, i-*66.
 - Providence, R. I. Tests and report by A. A. Knudson. 1900, ii-72.
 - Richmond, Va. Estimated depreciation of mains. 1903, ii-422.
 - St. Paul, Minn. Litigation. 1903, i-81.
 - Seattle, Wash. Street railway bonds and electrolysis. By W. S. Wheeler, 1901, ii-390.
 - Surveys for electrolysis and their results. Effect of double-trolley system. By D. H. Maury, 1903, ii-18, 74, 78.
 - Water-Works Association, Position of. 1901, i-468.
- Electrometallurgy of iron and steel. By M. Ruthenberg, 1902, ii-230; 1903, ii-265; 1904, i-350.

"1900, ii—112" means "Year, 1900, second volume, page 112."

Electromotive force; an objectionable term. 1903, i-Eng. Lit. Sup., April 16.

Elevated railways:

Berlin, Germany. Electric rapid transit railway. Line construction. Power supply and operation. Cost of work. Methods used to deaden noise on railway. 1902, i-165, 285, 392, *397; 1903, ii-201.

Boston. Erection of railway. Completion. By C. E. Fowler, 1900, i-*179; 1901, i-425.

Chicago, Metropolitan West Side:

Color of structure. 1902, ii-264, 429.

Loop terminals and transfer station. 1902, ii-*115, 264, 429.

Moving structure of 22 spans about 40 feet. 1902, ii-*79.

Color for structures in public streets. 1902, ii-264, 429.

Moving structure of 22 spans 40 feet, Chicago. 1902, ii-*79.

New York:

Car crowding and protest against. State Railway Commission's order. Third-track extensions. 1903, i-34.

Collisions. 1903, i-1.

Early history. 1902, i-84.

Fire on Third Avenue electric train, June 30, 1902. 1902, ii-1.

Ice on third rail. 1902, ii-522.

Lease to Interborough Rapid Transit Co. for 999 years. 1902, ii-474.

Motive power. Change to electricity. 1900, ii-85, 345; 1902, i-41, 265.

Power station and substations, Electrical machinery in. 1901, i-329; 1902, i-*82.

Supreme Court decision concerning third track from 116th Street to Christopher Street. 1902, i-125.

West Street franchise to New York & New Jersey Bridge Co. 1901, i-305, 320.

Noise:

Berlin, Germany, Methods used to deaden noise. 1903, ii-201.

Proposed concrete construction for reducing noise in Chicago. Other suggestions. By J. B. Strauss, 1904, ii-*446, 546.

Elevator accidents:

Chicago, Blakely Printing Co. Fall of freight elevator. 1900, i-201.

New York City, Various accidents in. 1902, i-493, 520; By C. R. Pratt, 1904, i-103, *124; By Edward Van Winkle, 1904, ii-154, *169, 201, 202.

Paterson, N. J. Department store. 1901, i-41.

Pittsburg, Pa. 1904, ii-222.

Public safety and restrictive ordinances. 1904, ii-333.

Elevators:

Air cushion, Ellithorpe, in Philadelphia City Hall. High drop test. Eggs as a means of testing elevator falls. 1902, ii-*295, 373.

Car transfer table and elevator for J. G. Brill Co., Philadelphia. 1902, ii-*42.

Contractors' elevator for use in taking down building. By A. H. Hartman, 1902, i-*486.

Electric:

"Duplex" or two-motor system. By C. L. Duenkel, 1903, i-119.

Washington Monument. 1901, ii-*114.

Electric vs. hydraulic elevators. 1904, i-537.

Formula for estimating number of elevators required for all buildings.

By G. W. Nistle, 1904, i-537; 1904, ii-10.

Frazier differential traction rope drive. Accident at 74 Broadway, New York City, Feb. 2, 1904. By C. R. Pratt, 1904, i-103, *124.

Hydraulic:

History of. Differential hydraulic elevator. Two-pressure hydraulic elevator. Elevators in Prudential buildings at Newark, N. J. By C. L. Duenkel, A. S. Bard, 1903, i-*118, 215.

Macy & Co., New York. Test of entire system. By R. P. Bolton, 1903, i-562.

Plunger lubricator. By Edward Van Winkle, 1904, i-*283, *494.

* denotes an illustrated article. † denotes an inset sheet.

Elevators:

Hydraulic: (Continued.)

- Quimby screw pumps direct-connected to electric motors. Tests. By F. A. Pattison, 1901, ii-*4.
- Selection and installation. By H. D. James, 1902, ii-*74.
- New York City. Amendment to Building Code proposed by Superintendent of Department of Buildings, J. A. Hopper, 1904, ii-267.
- Prudential Insurance Co., Newark, N. J. Hydraulic high-pressure elevators. By C. L. Duenkel, A. S. Bard, 1903, i-*118, 215.
- Safety devices:
- Grip on mine hoisting cages in France. 1900, ii-49.
- Pratt's improved form of centrifugal governor for actuating elevator safety device. By C. R. Pratt, 1902, i-*490.
- Safety appliances and the building code in New York City. By Edward Van Winkle, 1904, i-354.
- Tests of safety devices. Device for measuring force of retardation. Slab on helical springs. 1902, ii-*316.
- Tests of safety devices, Philadelphia City Hall. 1902, ii-*295.
- Washington Monument elevator. 1901, ii-*115.
- (See also Bins; Grain elevators; Rope; Stairways, Moving.)

Embankments:

- Boone County Ry., Chic. & Northwestern Ry. Building large embankments. Dumping earth from trestle work. 1900, ii-*98.
- Building with carts or wheel scrapers. 1902, i-58.
- Burlington & Missouri River R. R. Earth filling of high trestle. 1900, i-201.
- Carrying embankment across marshy ground. Detroit & Milwaukee R. R. in 1877. 1901, ii-387.
- Cars runing over track laid on ice. By L. L. Wheeler, 1903, i-*197.
- Cascade rock-fill, Erie R. R. 1900, ii-*440.
- Cincinnati Southern Ry. 1902, i-*146.
- Consolidating an embankment by flooding, Wachusett reservoir, Clinton, Mass. 1903, i-513.
- Construction and maintenance of railway embankments. Causes of settlement and slipping. English practice. Building in horizontal layers. 1902, ii-292.
- Cost, Estimating, of reservoir. 1903, ii-433.
- Dumping from a traveling bridge, Chic., Bur. & Quincy R. R. 1902, i-1, *42.
- Dumping from movable trestles, Illinois & Mississippi canal work. 1902, i-*479.
- Economy, Comparative, of embankments and trestles. By B. F. Mackall, 1901, i-378.
- Failure, on Copper Range R. R. Treacherous character of materials in cuts and embankments. 1901, i-*171.
- Hydraulic excavation, Cost of. 1902, ii-438.
- Lake embankments, Rutland-Canadian Ry. Rubble embankment. By J. W. Burke, 1903, i-*48.
- Picking pebbles out of earth embankments. 1903, ii-Cons. News Sup. Aug. 20.
- Replacing modern trestle with earthwork, Chicago, Indianapolis & Louisville Ry. 1901, ii-321.
- Report on grading for railway roadbeds and yards. American Railway Engineering and Maintenance of Way Association. 1901, i-199.
- Shrinkage. By J. L. Campbell, J. B. Johnson, H. P. Gillette, C. H. Tutton, 1900, ii-336, 355, 410, 429; L. B. Merriam, H. P. Gillette, W. Finnel, 1901, i-11, 30; By W. H. Herdman, 1902, ii-293; By J. A. Fulton, W. D. Faucett, E. G. Haines, 1904, i-227, 259, 330; 1904, ii-445.

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- Specifications for protecting slopes, Comments on. 1904, ii-288.
- Tabaud dam, Jackson, Cal. 1902, ii-*27.

"1900, ii—112" means "Year, 1900, second volume, page 112."

Embankments: (Continued.)

Temporary suspension bridge, engine and loaded cars always on embankment. Switzerland. 1902, ii-*122.

Timber in railway embankments. 1900, i-194, 179, *212, 274.

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Emery wheels, Bursting speed of. Results of tests. By C. H. Benjamin, 1903, i-571.

Employees belonging to militia organizations, Rule for. Vulcan Iron Works Co. 1904, i-178.

Employers' liability law in Great Britain. Report of Committee. Results of experience. 1904, ii-254.

Engine Builders' Association, Convention. 1900, ii-422.

Engine houses. (See Roundhouses.)

Engineering:

Agricultural engineering. By Elwood Mead, 1903, i-49.

Essentials necessary for successful practice in bridge engineering. By J. E. Greiner, 1903, i-322.

History of engineering proposed. 1903, ii-35; Eng. Lit. Sup. July 16, Aug. 20.

Marine engineering during ten years. By James McKechnie, 1901, ii-†139.

Problems in field engineering. Arnold Emch, 1903, ii-*601.

Rural engineering. 1903, ii-570.

Sanitary engineering course in engineering schools for municipal health officers. 1901, ii-8.

Unity of the four great branches of the engineering profession. 1903, i-453.

Work of the engineer. By James Mansergh, 1901, ii-187.

(See also Civil engineering.)

Engineering approximations, Inaccuracy in. By W. D. Taylor, 1904, i-150.

Engineering building. (See Union engineering building in New York.)

Engineering Company of America. Circular inquiry to engineers. 1903, i-370.

Engineering education. (See Education.)

Engineering employment bureaus, Work of. 1903, i-430.

Engineering ethics. 1900, i-326; 1903, ii-244; 1904, i-62.

Engineering library, An American. 1904, i-225.

Engineering literature:

Criticism of technical books. 1903, ii-Eng. Lit. Sup. Oct. 15, Nov. 12.

Nomenclature. Precision in the use of words. 1903, ii-Eng. Lit. Sup. Sept. 17, Oct. 15, Nov. 12. Cons. News. Sup. Dec. 3.

Engineering News:

Contributions to, prove unexpectedly useful. 1902, ii-336.

Correspondence column, Purpose of. 1903, ii-142.

Engineering literature. Publication of supplement. 1902, ii-522.

Engineering school notes made a separate department. 1903, ii-340.

Flattery from contemporaries. Appropriation of report without credit to Engineering News. 1902, ii-315.

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Inset sheet discontinued as a regular supplement. 1901, i-28.

Permanent record of drawings. 1900, ii-408.

Selection of matter for publication. 1902, i-332.

Thirtieth anniversary. 1904, i-400.

Unauthorized publication of engineering drawings. By D. H. Andrews, H. G. Tyrrell, 1901, i-470.

Engineering outlook for 1904. 1903, ii-543.

Engineering profession, National boundaries in. Action of Grand Trunk Pacific Ry. in deporting engineers from United States. 1904, ii-111, 182, 221, 523.

Engineering publications:

Beware of free useful information. 1902, i-30.

Errors in. 1901, ii-238.

Literature wanted for young engineers. 1902, i-155.

* denotes an illustrated article. † denotes an inset sheet.

Engineering schools:

American Bridge Co. School within its own works proposed. 1901, i-253.
 British view of American schools by Alfred Moseley. 1904, i-226.

Commercial engineer. Need for the establishment of a course in commercial engineering. By M. S. Ketchum, 1901, i-26.

Complaints, True cause of. 1901, i-101.

Cornell University, Gift of Baldwin Locomotive. 1903, i-153.

Correspondence schools:

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Co-operation of American School of Correspondence, Boston, with Armour Institute of Technology. 1902, ii-128.

Courses of study, Broadening of. 1904, ii-9.

Efficiency factor in engineering education. By Robert Fletcher, 1902, ii-17.

Electrical engineering courses. By Samuel Sheldon, William Esty, 1902, ii-6.

English language and the engineering student. 1903, ii-Eng. Lit. Sup. July 16.

Evil of excessive differentiation in engineering courses. By Edgar Marburg, 1904, ii-16.

French schools in the United States, Plans for. 1902, i-165.

Graduates:

On the staff of the New York Rapid Transit Railway Commission. 1902, ii-112.

"The technical graduate and the machinery department of railways". By W. F. M. Goss, 1904, i-298.

Growth of. Diagram of attendance. 1903, i-101.

Lafayette College, Easton, Pa. Dedication of the Gayley Laboratory. 1902, i-*291.

Massachusetts Institute of Technology:

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Inauguration of Dr. Pritchett as President, Oct. 24, 1900. 1900, ii-284.

Mathematical work in. Discussion beginning with the subject of setting slope stakes. By Antonio Llano, A. Miller, H. P. Gillette, C. G. Wrentmore, O. H. Tripp, B. F. La Rue, I. G. Walker, J. B. Davis, T. S. Burr, J. B. Johnson, A. W. French, P. C. Ricketts, G. T. Prince, Oscar Schmiedel, E. S. Gould, J. H. Griffith, Willis Whited, G. P. Starkweather, B. T. Killough, C. H. Tutton, J. N. Ambler, G. K. Hooper, J. L. Campbell, 1900, ii-46, 78, 182, 198, 264, 265, 281, 296, 298, *313, 314, 334, 335, 336, 355, 356, 389, 410, 429; By C. W. Comstock, 1901, i-102.

Need of technical high schools in our educational system. By V. C. Alderson, 1902, ii-71.

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Ohio State University. Experimental boiler plant, 1901, i-359.

Railway school at McGill University. 1904, i-128, 226.

Reform in technical training proposed. By E. B. Raymond, 1902, ii-7.

Rensselaer Polytechnic Institute:

Chemical Laboratory and Proudfit Memorial Building. 1903, i-173.
 Fire, June 9, 1904. By W. G. Raymond, 1904, i-*562.

Theses in engineering schools. By A. R. McKim, 1902, i-137.

University of Michigan. Notes on electric power plant. 1900, i-147.

University of Wisconsin:

Scholarship in municipal government. 1900, ii-92.

Summer school for apprentices and artisans. 1901, ii-365.

Washington University. Septic tank and proposed sewage purification studies. 1900, ii-529.

West Point as a model for civil engineering schools. By J. S. Sewell, 1904, i-517, 566; By E. S. Ball, 1904, ii-132.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Engineering societies:

- Co-operation and federation between. 1902, ii-500; By A. M. Feldman, F. V. McMullin, 1903, i-254, 277, 302; 1903, ii-23, 36; 1904, ii-131.
- Growth of the national societies, 1867-1904. Diagram. 1904, i-563.
- Interchange of club house privileges. 1903, ii-316.
- Membership, dues, income, property, etc. of national societies. 1903, i-510.
- Organization of sections in societies. By G. W. Colles, 1904, i-37, 83.
- Requirements for admission. 1904, i-109.
- Union building. (See Union engineering building in New York.)
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Engineers:

- Ability of an engineer, Difficulty of gaging. 1904, ii-363.
- Address to engineering students by J. A. L. Waddell. 1903, i-449.
- Advice to young engineers by Dr. B. W. Kennedy. 1903, ii-140.
- Army engineers:
 - Increase in the Corps of Engineers. Unfortunate results. Gen. Gillespie's recommendations. 1901, ii-472; 1904, i-152, 283, 330, 378.
 - Probity of army engineers and their small compensation. Case of Capt. King at Mobile, Ala. 1901, i-64.
- Canada. Discrimination against engineers from the United States. 1904, ii-111, 182, 221, 523.
- Chemical engineers, Opportunities for, in the ceramic industry. By Edward Orton, Jr., 1904, i-45.
- City engineers:
 - Fargo, North Dakota. Petition to have salary reduced. 1903, ii-590.
 - Methods of choosing. Should they be elected by popular vote, appointed by the mayor, or chosen by city council? By Emmet Steece, 1902, ii-98, 338.
 - Methods of choosing, in 25 American cities. Investigation by A. Marston and G. W. Miller. 1903, i-138.
 - Public recognition of importance of office. Election by the people, at Binghamton, N. Y. 1903, ii-292.
 - Shutting out politics in election of. Case of E. A. Steece, Burlington, Ia. 1902, i-292.
- Civil engineering and engineers. By J. F. Wallace, 1900, ii-49.
- Civil engineers:
 - Definition of civil engineer. 1903, i-524.
 - Duties in Navy and Army. By L. T. Boyle, M. T. Endicott, 1903, i-391.
- Commercial engineer, Duties of. By M. S. Ketchum, 1901, i-26.
- Compensation:
 - Comparison of individuals by salary and age. Relation between age periods and salary received. By F. H. Newell, 1904, ii-59, 60, 73.
 - Comparison with labor union workers. 1902, ii-236, 238, 265.
 - Compensation of engineers and doctors. 1903, i-12, 14, 36, 57, 103, 127.
 - Concerning a \$40 city engineer. 1902, i-134.
 - Electrical business. Results of an inquiry in Chicago. By G. A. Damon, 1904, i-325.
 - "Low-priced engineers." Advertisement in Engineering News. By N. C. Yuille, 1904, i-81, 130, 178, 203.
 - Mining engineers and United States geologists. By C. T. French, C. W. Hayes, F. H. Newell, 1903, i-218, 256.
 - Percentage basis for engineers' fees. 1904, i-400, 470, 518, 564.
 - United States Coast and Geodetic Survey engineers. 1903, i-327, 369.
- Contracting engineer, Trials and opportunities of. 1901, ii-328.
- County engineers, Work of, on road construction in New Jersey. By James Owen, 1903, i-106.

* denotes an illustrated article. † denotes an inset sheet.

Engineers: (Continued.)

- Degrees. "What should an engineering graduate have studied?" Use of letters C. E. By S. M. Barton, F. S. Davis, S. Whinery, 1904, i-200, 330, 403, 471, 516.
- Demand for engineers. 1902, ii-212.
- Demand for engineers of business ability. 1904, i-425.
- Duties of engineers in enforcing contracts. By A. J. Himes, 1902, ii-45.
- Education of engineers. By William Kent, 1903, ii-348.
- Engineer and the business man. By J. Swinburne, 1904, ii-567.
- Examination of Colorado irrigation engineers. List of questions. 1903, ii-534.
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- Farm surveys. New field of work for engineers. 1904, ii-153.
- Legal restrictions governing the practice of engineering. 1901, ii-15.
- Licensing engineers:
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 - Louisiana. Bill in Legislature to regulate practice of engineers. 1900, i-401.
- Municipal service, Position of the engineer in. By Alexander Dow, 1901, ii-420, 428.
- Naval engineers:
- Duties of civil engineers. By L. T. Boyle, M. T. Endicott, 1903, i-391.
 - Examinations. (See Civil Service examinations.)
 - Increase and reorganization of Corps of Civil Engineers. 1901, i-71; 1903, i-265.
 - New assignment of steam engineering and ordnance work. 1904, i-448.
 - Personnel Bill unsatisfactory in its working, according to the report of Admiral Melville. 1900, ii-280; 1901, ii-321.
 - Regrading in rank. President Roosevelt's decision. 1903, ii-244, 317.
 - Requirements for admission to Naval Civil Engineer Corps. 1902, ii-402.
 - Rules governing appointments. 1900, ii-305; 1903, i-441; 1903, ii-422.
- New York State. County engineers may be appointed. 1902, i-321.
- Newspaper idea of the fitness of practicing engineers for places on commissions. 1903, ii-79.
- Opportunities for young engineers in Mexico. By J. M. Alarco, 1901, ii-62.
- Opportunities for young engineers in the new possessions of the United States. 1902, i-309.
- Organizing a civil engineering corps. By F. H. Newell, 1904, ii-58.
- Relation of the architect and engineer to the design and erection of government buildings. By J. S. Sewell, 1902, ii-520.
- Rules for engineers' calculations. 1900, i-26.
- Sanitary engineers on local boards of health. 1904, ii-504.
- Specifications, engineers and contractors. Duty of the engineer toward contractors. By L. Y. Schermerhorn, H. P. Gillette, Willis Whited, 1902, ii-213, 237, 238, 264, 287, 403; By W. W. Amburn, J. C. Trautwine, Jr., W. D. Taylor, 1903, i-146, 150, 216.
- Twentieth century engineer. By Robert Moore, 1902, i-421.
- Women civil engineers. 1902, ii-131.
- Work of the twentieth century engineer. By James Mansergh, 1901, ii-187; By C. F. Scott, 1903, i-572.
- Engineers' Club of Philadelphia, Twenty-fifth anniversary banquet. 1902, ii-511.
- Engineers' pocketbooks:
- Early works on surveying. Bourne's work of 1834. 1900, i-239.
 - First American railway engineers' manual by S. H. Long. 1900, i-397.
- Engines:
- Energizing Momentum Engine, of London. "Poleforcia." 1900, i-174.
 - "1900, ii-112" means "Year, 1900, second volume, page 112."

Engines: (Continued.)

Heat engine problem. 1901, ii-458.

Power Multiplying Engine Co. of New York. Pneumatic power transmission. 1900, i-*173, 241.

"Waste-heat" engine. History of. Engine in Berlin Electrical Works. By E. F. Miller, 1902, ii-449, *456.

(See also Gas and oil engines; Hoisting engines; Locomotives; Marine engines; Pumping engines; Steam engines; Traction engines.)

Engraving machines, Hydrographic chart. Japanese Navy. 1901, ii*-163.

Entropy, Definition of. 1900, i-274; 1903, i-Eng. Lit. Sup. Feb. 19, Mar. 19.

Equalizer for hot blast supply to blast furnaces, Middlesbrough, England. By L. F. Gjers and J. H. Harrison, 1902, ii-*268.

Ericsson, Personal recollections of, by E. P. Watson. Moral standards in technical journalism. 1901, ii-24.

Errors, Concerning formulas for computing probable. By Horace Andrews, 1902, i-173.

Evaporation:

Experiments on evaporation from the soil at the Wyoming Agricultural Experiment Station. 1902, ii-187.

Rate of evaporation at Yuma, Arizona. Record for 1903. 1904, i-248.

Evaporator, Lillie multiple-effect. Water distilling plant at Dry Tortugas, Florida. 1900, i-*203.

Examinations for Health Inspectors in New Jersey. 1904, i-516.

(See also Civil Service examinations.)

Excavation:

Costs:

Hydraulic excavation for embankments and for placer mining. 1902, ii-438.

Sliding scale of prices for sewer trenching. Formulas. By E. K. Coe, W. G. Kirchoffer, 1903, ii-343, 433, 505; 1904, i-106.

Steam shovel excavation. By D. J. Hauer, 1903, ii-579.

Tunnel excavation by the N. Y. C. & H. R. R., Peekskill, N. Y. By G. W. Lee, 1903, ii-*531.

Economic handling of earth excavation. Suggestions. By J. H. Lane, 1904, ii-447.

Gravel digging and screening plant combined. 1904, i-*444.

Hydraulic excavation. Stripping shale beds for brick manufacture, Danville, Ill. 1904, i-*31.

Hydraulic excavation for embankments and placer mining. 1902, ii-438.

Rock-trench work, Boston, Mass. By F. I. Winslow, 1903, ii-363.

Specifications:

Back-filling trenches. 1903, ii-Cons. News Sup. Aug. 27, Sept. 3.

Classification of excavated material. 1903, i-274, 347.

Contradictory requirements for rock excavation. 1904, ii-333.

Spoil banks, Spreading. By S. F. Moeller, 1903, ii-456.

Width for sewer trenches in rock. 1904, i-Cons. News Sup. March 31.

(See also Earthwork; Grading; Tunneling.)

Excavators:

Auger excavator and conveyor on the Illinois & Mississippi canal. By S. H. Lea, 1900, i-*90.

Belt conveyor for handling excavated material in foundation work, New York City. 1900, i-*48.

Cableway scraper and chute for removing gravel bank. Tunneling on the Canadian Pacific Ry. By C. R. Coutlée, 1903, i-*292, 300.

Excavating and loading machine for transferring ore to railway cars. Fayal Iron Co. 1900, ii-*200.

Steam excavating and grading machine, carrying plow and conveyor. Bunnell Machinery Co. 1901, ii-*98.

Steam shovel cableway, Butler. Missionfield coal mine, Illinois. 1901, ii-*205.

* denotes an illustrated article. † denotes an inset sheet.

Excavators: (Continued.)

Trench excavating machine, Glencoe, Ill. F. C. Austin Mfg. Co. 1901, ii-*200.

(See also Cableways; Conveyors; Dredges, etc.)

Exhaust pipe head, Condensing. R. P. Bolton, inventor. 1903, i-*419.

Exhaust steam, Utilization of, in low-pressure steam turbines. By Leonce Battu, 1904, ii-282, 287.

Exhibitions:

Automobile, New York City, Nov., 1900. 1900, ii-337.

Fuel Exposition, Barcelona, Spain. April-June, 1901. 1901, i-217.

Glasgow International, 1901. By Benjamin Taylor, 1901, i-149; By G. Harwood Frost, 1901, ii-*201.

Lewis & Clark, Portland, Oregon, 1905. 1904, i-375.

Pan-American, Buffalo, 1901:

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Paris, 1900:

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Electrical exhibits. By Carl Hering, 1900, ii-367.

Engineering exhibit of Massachusetts. 1900, i-277.

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Mechanical engineering exhibits. 1900, ii-*105.

Mining and metallurgical exhibits. 1900, ii-*48.

Municipal engineering exhibits. 1900, ii-*72.

Railway rolling stock exhibits. 1900, ii-5.

St. Louis, 1904:

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Coal testing plant. 1904, ii-286.

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Engineering exhibits, General review of. 1904, ii-126, 199.

Engineering work. Plan of exposition grounds. 1903, i-*363; 1904, i-149.

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Grading exposition grounds. 1903, i-*364.

Intramural railway. Fire protection. 1902, ii-305, 325.

Locomotive exhibits. 1904, ii-*297.

Locomotive testing plant. 1904, i-*474.

Mines and metallurgy building. 1902, i-*448.

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Power plant, Service, Details of. 1904, ii-223, *509.

Power plant of the electric intramural railway. Comparison with plant at Chicago in 1893. 1904, ii-*320.

Expansion bearings. (See Bridge joints.)

Expert chemical work. 1904, ii-423.

Expert testimony, Value of. 1902, i-332.

Explosion, A versified. 1902, ii-451.

Explosions produced by ferro-silicon. By A. Dupre and M. B. Lloyd, 1904, i-488.

(See also Boiler explosions; Gas explosions; Mine explosions; Subways, Explosions.)

Explosives:

Joveite a safe and economical substitute for dynamite. Tests. Use of by N. Y. C. & H. R. R. R. By R. T. Dana, G. W. Hughes, 1903, i-73, 79, 80, 128, 197; 1904, i-81.

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Explosives: (Continued.)

Masurite. 1902, i-257.

Maximite. 1900, ii-*292; 1901, i-257.

New York City:

Municipal Explosives Commission, and its refusal to investigate explosives. 1903, i-174.

Rules to govern the storage and use of explosives, proposed. Report of Municipal Explosives Commission. 1902, ii-523, 530.

Safety in handling explosives. 1903, i-80; 1904, i-80.

Tests of high explosives. Experiments in attacking armor with high-explosive shell. By E. B. Babbitt, 1901, ii-388, 398.

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Export trade:

Packing goods for export. 1901, ii-102.

Parcels post, American. Domestic and foreign trade advantages. Review of Report made by Mahlon A. Winter. 1901, i-34.

Prohibitory tariff on beet sugar imports from Russia, and American reports of manufactured goods. 1901, i-49, 152.

Steel buildings for export. Possibilities in construction and approximate costs. By H. G. Tyrrell, 1901, i-†259.

United States as a competitor in international trade. 1901, i-336, 356.

United States export trade and tariff walls. Russia increases tariff rates on United States imports. 1901, i-49, 152.

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Extensometer, Autographic, Kenerson design. Used in Testing Laboratory of Brown University. By W. H. Kenerson, G. C. Henning, 1900, i-*63, 97.

Eyebars:

Breaking test of eyebar for the Quebec bridge. 1904, ii-*596.

Comparison of eyebars made by forging and those made by cutting from rolled plates. 1903, ii-246, 320, 342.

Diagram for finding bending stresses due to weight of bars. By W. E. Belcher, 1902, ii-49.

Making of 18-inch bar. By W. R. Webster, 1903, ii-325.

Manufacture of large eyebars for Thebes bridge. By P. S. Hildreth, 1903, ii-326.

Rolled steel eyebars in Glasgow, Missouri, bridge. Notes on early manufacture of eyebars. 1901, ii-56.

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Factories. (See Shops and factories.)

Falseworks:

Device for lowering bridge spans from falseworks to abutments, Union R. R. 1900, ii-*103.

East River bridge. Erection of Manhattan towers and end spans. By C. E. Fowler, 1900, i-†164.

Plauen, Saxony, bridge. Stone arch of 295 feet. 1904, i-*76.

Yellowstone River, for concrete-steel arch bridge. By H. M. Chittenden, 1904, i-*26.

(See also Bridge erection.)

Fans:

Steel plate fan for mine ventilation, Modoc Coal Co., Glouster, Ohio. 1902, i-*512.

Tests of centrifugal mine ventilating fans. Luke-Fidler colliery fan. Comparison of results with other fans. By R. V. Norris, 1904, i-*410.

Tests of a direct-connected 8-ft. fan and engine. Fans for paper mills. By E. S. Farwell, 1903, ii-*55, 58.

Turbo fans, Test of, at Commentry. By A. Rateau, 1904, i-547.

* denotes an illustrated article. † denotes an inset sheet.

Fans: (Continued.)

Ventilating fans, Some experiments with. Pitot tube for determining velocities of air currents in fans. Characteristic curves of fans with cast shells. By D. W. Taylor, 1904, ii-*387.

(See also Blowers.)

Fascines. (See Mattress construction.)

Fast trains. (See Trains, Fast runs.)

Feed-water filters. Removing oil and mud from boiler feed-water. 1901, i-*436, 450.

Feed-water heating:

Locomotives, Experiments on. Use of exhaust steam. 1901, i-*460, 469.

Multo-current heater. Blake & Knowles Mfg. Co. Use of baffle plates. 1904, i-489.

Nordberg pumping engine. Water heated in separate stages to near boiling point. 1900, ii-*118, 128.

Value of heaters for removing scale. Investigation with Iowa well waters at Cornell College. By Nicholas Knight, 1904, ii-148, 151.

Feed-water purification:

Cleveland Stone Co., in air compressor plant at Gray Canon Quarry. By L. J. Wightman, 1904, ii-3.

Detroit, Mich. Experiments at the Edison Co. on separating oil from condensed steam. By L. M. Booth, J. R. Bibbins, 1902, i-*406, 408, 415, 437, 522; By A. W. Buel, 1902, ii-34.

(See also Locomotive boilers and fireboxes, Water purification; Oil separators.)

Fences:

Railway fencing. By R. W. Leonard, 1903, i-473.

Reports at American Railway Engineering and Maintenance of Way Association. 1903, i-281; 1904, i-264.

Snow fences. Report to Association of Railway Superintendents of Bridges and Buildings. 1900, ii-268.

Ferro-silicon, Explosions produced by. By A. Dupre and M. B. Lloyd, 1904, i-488.

Ferry, Staten Island. Municipal ownership recommended. 1903, ii-25.

Ferry bridges. (See Bridges, Ferry.)

Ferry steamers:

"Bremen," Trials of. Analysis of resistance and losses. Compared with "Bergen" and "Cincinnati." 1903, ii-481.

Car transfer, Pere Marquette Ry., Lake Michigan. Steel boat. 1900, ii-241.

Staten Island Ferry. Steel hulls and wooden superstructure. 1904, i-612.

Fieldbooks. (See Engineers' pocketbooks.)

Field glass, Porro prism. By W. R. Warner, 1901, ii-458.

Filing cases for drawings, Steel. Drawing office of Pitts. & Lake Erie R. R. By R. P. Forsberg, 1902, i-*4.

Filter beds. (See Sewage purification; Water purification.)

Filters:

Coke, for removing oil from condensation water. Edison Co., Detroit. By J. R. Bibbins, 1902, i-*407.

(See also Feed-water filters; Sewage purification; Water purification.)

Financial loss due to preventable diseases. 1904, i-425.

Fire-alarm telegraph, Wireless automatic. 1903, ii-89.

Fireboxes. (See Locomotive boilers and fireboxes.)

Fire curtains of expanded metal and plaster in factories. Use of Sackett plaster board. By William Parker, 1903, ii-213, 568.

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Fire department of Berlin, Germany, Methods of. 1900, i-392.

Fire doors, Requirements of double. By L. H. Kunhardt, 1904, ii-*424, *545.

Fire engines, Tests of, at Elmira, N. Y. By W. W. Christie, 1904, ii-11.

Fire insurance:

Effect of inadequate water supply on rates, Pittsburg. 1902, i-172.

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Fire insurance: (Continued.)

Municipal patronage of fire insurance companies a mistake. By A. W. Hardy, 1902, ii-12, 112, 266.

Mutual factory fire insurance in the United States. Report by Edward Atkinson. Investigation of causes of fires. 1900, i-360.

Fireproof construction:

Concrete building construction in New York City. 1902, ii-521.

Does it afford added fire protection? By P. M. Stewart, 1903, ii-343.

Fire effects:

Baltimore fire, Feb., 1904:

Details of fire. 1904, i-*145, 258, 284.

Exterior wall damage. 1904, i-*261.

Opinions of experts. 1904, i-169, 194, 200.

Report of Citizens' Committee on Buildings. 1904, i-*169.

Report by C. L. Norton and J. P. Gray to Insurance Engineering Experiment Station. 1904, i-516, 528.

Report to the Chief of Engineers, United States Army. By J. S. Sewell, 1904, i-276, 331.

English spinning mill fires. Breaking of cast iron columns. 1903, i-*21.

Horne building, Pittsburg. Fire of April 7, 1900. 1900, i-*266.

Masonic Temple, Chicago. 1904, i-*134, *178.

"Protection of fireproof buildings against exposure fires." 1904, i-237.

Rochester fire of Feb. 25, 1904. 1904, i-*220.

Fireproofing steel work in buildings. Legal decision in Germany. 1902, i-501.

New York City. Violation of the building law by the Department of Buildings. 1901, ii-417.

Notes on fireproofing city buildings. By P. M. Stewart, 1904, ii-265.

Tests:

British Fire Prevention Committee. Glass casements. Girder coverings. 1900, i-13, 201.

New York Building Department. W. W. Ewing, Engineer. Tests of plaster, metal lath and plaster, tile and concrete. 1901, ii-*482, 489.

University of Cincinnati. Ferro-concrete and steel-frame construction. By C. W. Marx, 1904, i-154.

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Fireproof cotton, linen and woolen goods in Germany. 1900, i-186.

Fireproof material called Uralite, Manufacture of, in England. 1902, ii-174.

Fireproofed wood:

Coatings for wood. Fire retardant paints. Method of making tests. 1901, i-460.

Ferrell process for preserving and fireproofing wood and textile fabrics. 1904, i-111.

Methods of testing fireproofed wood. By E. P. Goodrich, 1902, i-483.

New York City:

Compulsory use of fireproofed wood. Ordinance vetoed by Mayor. 1904, ii-71, 114.

Proposed prohibition of fireproof wood. 1902, ii-89.

Processes of fireproofing by the Electric Fireproofing Co., The American Wood Fireproofing Co. and the New York Fireproof Wood Co. Tests and cost of treated wood. 1901, i-459.

Report of Insurance Engineering Experiment station, Review of. By Edward Atkinson, 1902, ii-169, 214.

Standard tests for New York City. Plans abandoned. 1902, i-352; 1903, i-205.

Testing fire-resisting qualities. Timber tests of treated and untreated wood. Shavings test. By Ira H. Woolson, G. E. Mason, 1902, i-*148, 153, 177.

* denotes an illustrated article. † denotes an inset sheet.

Fire protection:

- Auxiliary pipe systems for extinguishing fires. New York City. Recommendations. Use of salt water. Report by Nicholas Hill. 1900, i-256; 1904, i-176, 224, 287, 328.
- Brooklyn. Report on high pressure service. By I. M. de Varona, 1904, i-288.
- Chicago. High pressure water supply system proposed. Members of Commission. Statement of Advisory Committee. Report by G. W. Jackson. 1902, ii-242; 1903, ii-38; 1904, i-*197.
- Danger of electric light and trolley wires to firemen when fighting fires. By M. W. Mead, 1901, ii-135.
- Does fireproof construction afford added protection? By P. M. Stewart, 1903, ii-343.
- Electric pumping plant protection. Quimby screw pump. Results of tests. By F. A. Pattison, 1901, ii-*4.
- Factory fire insurance on mutual plan. Report by Edward Atkinson. Investigation of causes of fires. 1900, i-360.
- Georgetown, Ky. Legal decisions. 1902, ii-348.
- Indianapolis. Contracts and rates of Indianapolis Water Co. for fire protection lines. 1903, ii-63.
- Inside fire protection. Discussion at American Water-Works Association. 1903, ii-18.
- Investigation of fire risk and fire protection in the United States by National Board of Fire Underwriters. 1904, i-449, 467.
- Jersey City, N. J. Tax for fire protection. 1901, i-48.
- Manufacturing plants. Dangerous work in isolated cells. Chemical extinguishers. Fire at General Electric Co.'s Works. 1901, ii-40.
- Maps of high-pressure systems in various cities. 1904, i-198.
- Mills at Lowell, Mass. Object-lesson in the volume of water required in crowded mill yards. By J. R. Freeman, 1903, ii-124.
- New York City. High pressure water system. Salt-water system. By Nicholas Hill, 1900, i-256; 1904, i-176, 224, 287, 328.
- Private damages for failure to afford protection denied by Supreme Court of Mississippi. 1901, i-1.
- Private fire services:
- Fire protection service of factories and other industrial establishments. Reports of the New England and the American Water-Works Associations. 1902, ii-212, 216, 349.
 - Investigation of the regulation of water supplies by the New England Water-Works Association. 1903, i-355.
 - Shall water departments charge for private fire lines and shall meters be placed thereon? By F. A. W. Davis, 1903, ii-62.
- Proposed experiment station for the study of fire prevention proposed by Edward Atkinson, 1902, i-345, 352.
- Shutters and other devices for protection against exposure fires. By J. R. Freeman, 1904, ii-35, 41.
- Water curtains in Chicago. 1904, i-128.
- West Asbury Park, N. J. Suit against water company for failure to provide fire protection. 1904, i-199.
- (See also Water rates.)
- Fire pumps. (See Pumps, Fire.)
- Fire shutters. By J. R. Freeman, 1904, ii-35, 41.
- Fire streams. Effect of long lines of hose. Experiments with 2½ in. fire hose, by S. A. Charles. Diagram comparing experiments by Mr. Charles and J. R. Freeman. Table by William Harkness. By S. A. Charles, William Harkness, I. P. Church, 1902, ii-24, 49, 81; 1903, i-236; By H. J. I. Bilton, S. A. Charles, 1903, ii-505.
- Fires:
- Baltimore, Md., Feb. 7, 1904. Rebuilding of city. Need of a municipal program. 1904, i-127, 128, 152; By D. J. Hauer, 1904, i-153, 511, 516.

(See also Fireproof construction, Fire effects, Baltimore.)

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Chicago:

Iroquois Theater, Dec. 30, 1903. Report of Experts on condition of other theaters. 1904, i-13, *21, *34, 60, 65.

Masonic Temple, Jan. 25, 1904. 1904, i-*134, *178.

Electric railways. (See Electric railway accidents.)

English spinning mills. Experiences with cast iron columns. 1903, i-*21.

General Electric Co., Schenectady. Fire in isolated brick cell. Handling inflammable liquids. 1901, ii-40.

New York harbor, North German Lloyd steamships and piers. 1900, ii-1, 26.

Pacific Coast Borax Co., Bayonne, N. J. Concrete-steel building. By E. L. Ransome, 1902, i-285, 334.

Park Avenue Hotel, New York City, Feb. 22, 1902. 1902, i-165.

Paterson, N. J. Tests of fireproof construction. 1902, i-141.

Record of large fires in the United States and Canada, 1820-1904. 1904, i-447.

Rensselaer Polytechnic Institute. 1904, i-*562.

Rochester, N. Y., Feb. 25, 1904. Effect of fire on fireproof buildings, 1904, i-*220.

Steamer "General Slocum" in East River, New York, June 15, 1904. Responsibilities of inspectors. Decision of local Board of Steamboat Inspectors. Indictments by Federal Grand Jury. Inspectors and their responsibilities. Sprinkler systems suggested. 1904, i-563, 588, 590, 611, 613; 1904, ii-43, 73, 110, 113, 296, 366.

Theater fires of the last century, List of. 1904, i-23.

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Fit allowances. Recent practice in forcing, shrinking, driving and running fits, and limits for limit gages. By S. H. Moore, 1903, i-563.

Flanges. (See Car wheels; Pipe.)

Flashboards. (See Dams.)

Flood discharge. (See Hydraulic formulas; Rainfall; River gagings.)

Flood prevention:

Forest preservation and flood prevention. By C. T. Johnson, J. B. Lippincott, 1903, i-324, 369, 478, 566.

New York. Report of Water Storage Commission. 1903, i-115, 183.

Flood protection:

East St. Louis, Ill. Proposed levees and relief canal. Relation of snow to the June rises of the Mississippi River. By J. F. Parr, W. D. Taylor, 1903, i-*118, 179.

Regulation of rivers and flood protection. 1904, i-256.

Floods:

Albany, N. Y. Damages to passenger bridge and station of the Delaware & Hudson Ry. 1900, i-*132.

Galveston, Texas:

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Plans for protection. Engineers' report. 1902, i-77, 343.

Protection of Galveston from ocean storms. 1900, ii-173, 180, 196, 205.

Sanitary cleaning, after great storm of 1900. Extracts from report made to New York Chamber of Commerce. By G. A. Soper, 1901, i-301.

Government engineers and responsibility for floods. 1903, i-566.

Heppner, Oregon. Flood of June 14, 1903. By J. T. Whistler, 1903, ii-53.

Kansas City, Mo., May, 1903. Bridge repairs. By J. A. L. Waddell, 1903, ii-*233, 244, *397.

Mississippi River. (See Rivers, Mississippi.)

New York and New Jersey, Oct., 1903. 1903, ii-352, *377, 388.

Notable floods. 1902, i-393.

Paterson, N. J., Oct., 1903. Flood damage to bridges. 1903, ii-352, *377, 388.

* denotes an illustrated article. † denotes an inset sheet.

Floods: (Continued.)

Report on the Southern river floods of May and June, 1901. By E. W. Myers, 1902, ii-*102.

Susquehanna River, March, 1904. Brief history of other floods. Flood details of 1904. By J. C. Hoyt and R. H. Anderson, 1904, i-*393, 400.

Floor beam concentrations under wheel-loads, Graphical method of finding. By R. H. Bulloch, L. J. Johnson, 1903, i-454, 501.

Floor beams of plate girder bridges, Atchison, Topeka & Santa Fe Ry. 1903, i-*484.

Floors:

Cement floors. Car flooring called "Monolith." Pullman Co. 1900, i-254.

Concrete slabs and electrically-welded galvanized wire netting, for coal sheds. Manila, P. I. naval coaling station. 1902, ii-93.

Concrete-steel:

American fireproof floor. Test by New York Building Department. 1902, i-*442.

Arched and flat slabs for Metropolitan Building, New York City. 1904, ii-*597.

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Baltimore fire of Feb. 8, 1904, Floors in. 1904, i-*169.

Cincinnati, Ohio, Ingalls Building. 1903, ii-*91.

Columbian system. Fire, water and weight tests for Boston & Albany R. R. By F. P. McKibben, 1901, ii-*378.

De Valliere system. Static and dynamic load tests under direction of R. C. Hill, Philadelphia. By E. S. Powers, 1902, ii-*443.

Failures:

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Failure under test at J. L. Mott Iron Works, Trenton, N. J. 1903, ii-*553.

Milwaukee failure. Building under erection for Johnson Electric Service Co. 1903, i-324, 328, 357, 381.

Paddington Building, Chicago. 1902, ii-*478.

Fire test of flat arch floor, Boston. 1901, i-*464.

Foundry floor at Worthington hydraulic works. 1903, ii-*584.

Hennebique system. Weight test at Cleveland, Ohio, Dec. 16, 1902. 1903, i-81.

Load test of, Frankford Arsenal, Pa. 1904, ii-548.

Lock woven metal concrete floor. Test by New York Building Department. 1902, i-*441.

Ransome system. Tests by New York Building Department. Comparative loading tests of stone and gravel concrete floors. 1902, ii-*544.

Strength of flat plates, with an application to floor panels. By S. E. Slocum, 1904, ii-22.

Test by New York Building Department. Load and fire test. 1904, i-624.

White fireproof floor. Test by New York Building Department. 1902, i-*442.

English spinning mill fires and floors. 1903, i-*21.

Failures:

Causes of failure of concrete-steel floors. By Julius Kahn, 1904, i-*66.

Milwaukee concrete-steel, under erection for Johnson Electric Service Co. 1903, i-324, 328, 357, 381.

Mott Iron Works, Trenton, N. J. Failure of concrete-steel floor under test. 1903, ii-*553.

Overloading floors in unfinished buildings with building material. 1904, i-152.

Paddington Building, Chicago. Concrete and metal floor. 1902, ii-*478.

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Warehouse floor in Minneapolis, Minn. Inefficiency of joist hangers of the stirrup type. 1902, ii-389, *420, 425, 475, 476; F. E. Kidder, E. Haupt, 1903, i-*58, 128; 1903, ii 172.

Live loads on floors. Discussion of C. C. Schneider's specifications. 1904, ii-404.

Loads and weight of crowds:

New York building laws. By Gunvald Aus, L. J. Johnson, 1904, i-352, 360, 361.

Tests at Harvard University. By L. J. Johnson, C. M. Spofford, 1904, i-352, 360, 426.

Tests by Mr. Hunscheidt, of Bonn, Germany. 1904, ii-406.

Measuring deflections of floor panels in load tests. Apparatus. By Edward Godfrey, C. H. Miller, 1904, ii-*178, *289.

Roundhouse floors of New York Central R. R. 1902, ii-119.

Tile:

Experiences in New York, in buildings under construction. 1900, i-242. Guastavino arches. Tests by New York Building Department. 1901, ii-49.

Maurer clay-tile fireproof floor for long spans. 1901, ii-*190.

Trainshed floor at Chicago terminal station. 1903, ii-*117.

Vulcanite fireproof floor. Fire and water test, Philadelphia, Pa., by H. S. Richards, 1902, i-*116.

Wooden joists filled between with concrete. Fire test by British Fire Prevention Committee. 1900, i-381.

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Flow of water. Device for measuring flow of driven wells. Hamilton, Ohio. 1902, ii-260.

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Flumes:

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Puget Sound Power Co. 1904, ii-*273, *274.

Sand settling basins at end of flume, Redlands, Cal., power plant. By E. Duryee, 1903, i-*133.

Screen, Traveling, for removing twigs from water. Redlands power plant. By E. Duryee, 1903, i-*133.

Semicircular wood stave flumes with round-iron binders used in California. Guy Sterling, inventor. 1902, i-374.

Toluca Electric Light & Power Co., San Simonito, Mexico. 1903, ii-*151.

Wachusett dam. Temporary flume, during construction of dam. By A. D. Flinn, 1900, ii-*177.

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German automatic. Geiger Sanitary Appliance Works. 1902, ii-*447.

Walker automatic. Compound trap and secondary siphon. 1900, i-*207.

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Flywheels:

Bursting of small cast iron flywheels. Tests at Case Scientific School, Cleveland. By C. H. Benjamin, 1901, ii-*462.

Bursting of wheels at Detroit, Mich. By R. Biddle, 1900, ii-356.

Bursting test of four-foot wheels. By C. H. Benjamin, 1904, ii-*534.

Computing maximum revolutions for. By W. H. Boehm, 1903, i-91.

Flywheel capacity for engine-driven alternators. By W. I. Slichter, 1902, ii-515.

Material in rim. Cast iron the poorest material used. Wood-rimmed wheels safer. By C. H. Manning, 1901, i-175.

Safe speeds for flywheels. By W. H. Boehm, 1902, ii-250.

* denotes an illustrated article. † denotes an inset sheet.

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6,000-HP. rolling mill engine, 24 feet in diameter. 1902, ii-*138.

Wooden lagging for engine flywheels. Dodge Mfg. Co. 1901, i-*126.

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Isle of Wight experiments. 1902, i-241.

System of signaling used in England. By W. S. Boulton, 1900, i-*387.

Fog horn, Large, in the Gulf of St. Lawrence. 1901, ii-365.

Forests and forestry:

College of Forestry, Cornell University, Closing of. 1903, i-557, 566.

Coming exhaustion of nature's stores. 1901, i-80.

Discussion at annual meeting of National Irrigation Association, Chicago, Nov., 1900. 1900, ii-378.

Effect of forests on snow and their combined effect on water supply. 1901, ii-209.

Expert aid by Bureau of Forestry to enterprise in timber culture and treatment. 1904, ii-239.

Forest preservation and flood prevention. By C. T. Johnson, J. B. Lippincott, 1903, i-324, 369, 478, 566.

Forester and forestry, Misapplication of term. 1903, ii-Eng. Lit. Sup. Sept. 17.

New Jersey. Relation of forests to water supply. By C. C. Vermeule, 1900, ii-58.

Reservations of the United States. Proposed national park in Southern Appalachian Range. 1901, i-71, 100, 156.

Surveys of the United States. By H. M. Wilson, 1901, ii-20.

Water-works drainage areas. Metropolitan Water and Sewerage Board; Middletown, Conn.; Woonsocket, R. I.; New Haven, Conn.; Hartford, Conn.; Johnstown, Pa. 1903, i-62.

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Forges, Portable folding, Army and Navy. 1900, ii-*384.

Forgings, Specifications for steel. International Association for Testing Materials. 1901, ii-*11, 12.

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Formulas:

Parabola for empirical formulas. By C. H. Lindenberg, 1902, i-482.

Use of, in the design of engineering works. By E. S. Gould, 1904, ii-152, 200.

Fort, Floating, for coast defence. 1904, ii-281.

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Cement grout. Injecting into sand or gravel. By J. T. Norton, A. R. Eldridge, 1902, i-*35, 113, 115.

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Chicago. Development of shallow and deep foundations for Chicago buildings. 1904, ii-*560.

Chimney foundations:

Asnieres, near Paris. Caisson foundations for chimney of sewage disposal works. 1900, i-417.

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Difficulties at Superior, Wis., pumping station. By R. D. Chase, 1901, i-143.

Mutual Life Insurance Building, New York City. Underpinning adjacent buildings. Piling. Nature of grounds. Caissons. By T. K. Thomson, 1901, i-*221.

Pressures on the foundation footings for walls of buildings. By E. A. Kemmler, F. T. Daniels, J. H. Gregory, F. E. Robertson, 1901, i-30, 82, 191.

Reconstructing defective:

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"1900, ii-112" means "Year, 1900, second volume, page 112."

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Soft ground, French method of sinking and compacting pillars of hard material in. Use of castings in pile-driven frame. Dulac and Ducloux invention. 1900, ii-*209, 232.

Wells at Koyakhai bridge, Bengal-Nagpur Ry. By G. W. Eves, 1901, ii-*493.

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Founding, Iron, Technical education in. Training foundry chemists. Training students in the principles of scientific and commercial founding. Edward Kirk, T. D. West, 1900, i-398.

Foundries:

Sturtevant, B. F., & Co., at Hyde Park. Inter-transportation system. 1903, ii-*417.

Worthington hydraulic works at Harrison, N. J. 1903, ii-*584.

Foundry cupolas, Blowing of. Investigations by Buffalo Forge Co. 1904, ii-66.

Foundry economy. By Richard Moldenke, 1902, i-222.

Foundry industry, Changes probable. By Richard Moldenke, 1903, i-264.

Foundry metallurgy. By H. E. Field, 1901, ii-29.

Foundry practice, Notes on. By E. B. Gilmour, 1901, i-328.

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Foundry supplies, Specifications for. J. I. Case Threshing Machine Co. 1902, ii-184.

France, Railroad and other things in. By F. A. Mahan, 1902, ii-338.

Franchises:

Cuba, Franchises in, and the Foraker resolution. 1901, i-396.

Definition of franchise. 1900, i-352.

Electric railways on country roads. Proposed Pennsylvania road law. By Arthur Kirk, W. C. Statler, 1901, i-153, 190.

Garbage franchise, San Francisco, Cal. By F. J. Mills, 1900, i-318, 325.

New York franchise tax law. 1903, i-421.

Perpetual franchise wanted by an electric lighting company at East Orange, N. J., 1902, i-28.

Remuneration for franchises. 1900, ii-425..

Street railway franchises:

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Antwerp, Belgium. Consolidation of franchises. 1902, i-309.

Brussels, Belgium. Revision of franchises. Conditions of agreement. 1901, ii-494.

Chicago. Bill to regulate franchises. Report of Commission. Municipal control suggested by Geo. C. Sikes. 1901, i-28, 39, 57; 1901, ii-348, 388.

New York Interborough Ry. Co. Franchise granted. 1903, i-336.

Water-works at Menominee, Mich. Suit between municipal authorities and Menominee Water Co. involving franchise rights of company. Supreme Court decision. 1900, ii-234.

Freight car interchange traffic at Chicago. 1902, i-8, †12.

Freight houses:

C., C., C. & St. L. Ry., Cincinnati, Ohio. Details of building. Rapid construction. 1901, ii-*16.

Double decked terminal, London, Great Central Ry. By E. E. R. Tratman, 1900, ii-376.

Fruit houses of Chic., Mil. & St. Paul Ry. Minneapolis, Minn. 1902, i-*226.

Loop terminals of Harlem Transfer Co., New York. By E. E. R. Tratman, 1900, ii-*377.

Report on, at American Railway Engineering and Maintenance of Way Association. In-bound and out-bound freight houses. 1902, i-279.

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* denotes an illustrated article. † denotes an inset sheet.

Freight rates:

Anthracite coal. Delaware Valley & Kingston Ry. Proposed rates. Rates on soft and on anthracite coal compared. 1900, i-150, 156.

Classification and freight rates discussed at Chicago at meeting between commercial organizations and Southern Classification Committee. 1900, ii-17.

Comparative cost of fast and slow freight service. Chart showing economical speed and loading for freight trains. By W. B. Poland, W. E. Miller, 1904, ii-495, 595.

Consolidations and combinations of railways and their influence in advancing railway freight rates. Tonnage of Morgan and non-Morgan roads. 1901, i-28, 48.

Europe. Comparative cost of rail and water transportation. 1900, ii-44.

German railway rates, 1903, ii-60.

Influence of the increased size of freight trains and locomotives. 1901, ii-408.

Investigation of advance in rates by Interstate Commerce Commission. 1902, ii-500.

Iron and steel products. Lower rates on Feb. 1, 1901. 1901, i-41.

Low freight rates for water shipments. Shipment of wheat from Portland, Ore., to Australia. 1902, ii-521, 540.

Rail and water rates in 1903. By K. W. Blackwell, 1904, i-142.

Relative freight rates on large and on small shipments. 1900, i-145.

Two mills per ton-mile. 1900, ii-312.

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Friction clutches:

Hele-Shaw clutch transmitting 80 HP. at 60 revolutions per minute. Reversing friction clutch. By H. S. Hele-Shaw, 1903, ii-*180.

Philips clutch. By T. H. Smith, 1901, i-*412..

Fritz, John, Celebration of 80th birthday of, in New York. John Fritz medal. 1902, ii-128, *383; 1903, ii-96.

Frizell's system of air compression. 1902, i-480.

Frogs:

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Locating turnouts and frogs, Methods for. By C. M. Kurtz, 1904, ii-*177.

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Switching yards of Chicago Transfer & Clearing Co. 1902, i-*12.

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Fruit houses of Chic., Mil. & St. Paul Ry., Minneapolis, Minn. 1902, i-*226.

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Fuertes, Estevan Antonio, Biographical sketch of. 1903, i-82.

Furnace pipe, Size of. Table compiled by W. G. Snow. 1900, i-238.

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Corrugated boiler furnace, Method of construction. 1900, ii-48.

"Cross draft" smokeless furnace. 1900, ii-*245.

Fox and Morison corrugated furnace tested by Bach, of Stuttgart, Ger. 1904, ii-244.

Ingot-heating furnace, Improved type of. By F. H. Daniels, 1901, i-*420.

Oil-burning. (See Oil as fuel.)

Oil-gas furnace, Acme. 1903, i-*111.

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Puddling furnace, Roe. 1902, i-417.

Smoke prevention in Harris furnace. Tests at Mineral City, Feb., 1903. 1903, i-*460.

Tests of furnace efficiency. By A. Bement, 1903, i-522.

Truck support for furnace bottoms. By H. A. Mather, 1903, i-*344.

Walker smokeless furnace. Results of efficiency tests. 1900, ii-*436; By R. L. Walker, 1901, i-10.

Westlake boiler furnace for burning powdered coal. Tests by Faber du Faur & Donnelly. 1901, i-*178.

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Fusible plugs for steam boilers. 1902, i-*355.

G.**Gages:**

Pressure. Liquids under high pressure. Experiments at West Virginia Agricultural Experiment Station. By F. H. Stillman, 1900, ii-*236.

Railway:

Change of gage, 42 miles, in 5 hours, Cin., Geo. & Portsmouth R. R. 1902, ii-249.

Locomotive driving wheels, Wear of, on the Chic., Bur. & Quincy R. R. and the Chic., Mil. & St. Paul Ry. 1900, i-*216.

Railway gages in Australia. Various gages and the consequent difficulties. 1902, i-88.

Tie-plate setting and surfacing gage. Table showing time consumed in setting and embedding tie-plates, Buf., Roch. & Pitts. Ry. 1900, ii-*81.

Widening gage on the Burlington System. 1902, ii-29.

Rain, Ferguson automatic recording. Use at Worcester, Mass., sewage purification works. 1900, ii-448.

Water meter, Metcalfe, for use with Venturi meter, Cold Spring, N. Y. By C. P. Paulding, L. M. Hoskins, M. M. y Rivera, 1901, i-*148, 322.

Gagings of sewage flow. (See Sewer gages; Sewer gagings.)

Garbage collection:

Cleveland, Ohio. Detachable steel boxes sent to plant by rail. 1900, i-358.

Columbus, Ohio. Collection in steel tanks and shipped by rail to reduction plant. 1900, ii-47.

Dustless refuse handling in Berlin, Germany. 1903, i-38.

Milwaukee, Wis. System of collection. Rules for householders. Costs. 1902, i-*64.

Moline, Ill. Steel dump carts. Costs. Early Methods. By Edward Kittilsen, 1900, i-90.

New York, 1897-1900. 1901, ii-120.

Philadelphia. Controversy over contracts. 1901, i-41.

St. Louis, Mo. Report of municipal committee after visiting various cities. Figures for collection and disposal. 1904, i-33.

San Francisco, Cal. Costs. By F. J. Mills, 1900, i-*318, 325.

Garbage cremation:

Atlanta, Ga. Lester furnace. 1901, i-105.

Buenos Ayres. Proposed garbage furnaces with heat utilization. Report by Commission. 1901, ii-95.

Chicago electric lighting station. Wright crematory. Utilization of garbage furnace heat. 1901, i-120, *124, 191.

Clinker, Utilization of. Bradford, England. Clinker crushed in mortar mills and sold for concrete, plaster, etc. 1900, i-273.

Comparative merits of cremation and reduction. Garbage disposal in Chicago. By A. R. Reynolds, 1901, i-191.

Engineering investigation of garbage furnaces at Trenton, N. J., by Rudolph Hering. Report. 1902, ii-96, 190, 197.

* denotes an illustrated article. † denotes an inset sheet.

Garbage cremation: (Continued.)

Engel furnace at Milwaukee, Wis. 1902, i+65.

England:

Burning of town refuse at West Hartlepool, Blackpool, Manchester and Westminster. By George Watson, 1904, i-612, *624.

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Practice in refuse disposal furnaces. Paper by F. Leslie Watson before Royal Institute of Public Health. 1902, ii-*503.

Hamburg, Germany. Notes. 1904, i-573.

Heat, Utilization of, at Rochdale, England. 1900, i-273.

Lester furnace at Atlanta, Ga. 1901, i-105.

Milwaukee, Wis.:

Bids for right to use patented systems wanted. 1900, i-169.

Crematory on Jones Island. Engel furnaces. 1901, i-187.

History of garbage disposal. 1902, i+63.

Moline, Ill. Furnaces rejected, did not fulfill contract requirements. By Edward Kittilsen, 1900, i-90.

Montreal. Quantity of matter burned and operating expenses for 1898. 1900, i-128.

New York City. Proposed light refuse crematory on dumping pier designed by H. de B. Parsons, 1902, i-*314.

San Francisco, Cal. Thackeray furnaces. Collection of garbage. Franchise. Legal difficulties. Disposal of ashes. Costs of cremation. By F. J. Mills, 1900, i-*318, 325.

Shoreditch plant, London, England. By A. R. Reynolds, 1901, i-191; 1904, i-536.

Specifications for garbage furnace at the Navy Yard, League Island, Pa. 1902, i-5.

Thackeray furnace at San Francisco, Cal. Costs. Franchise. Disposal of ashes. By F. J. Mills, 1900, i-*318, 325.

Toronto, Canada. Notes on the garbage destructor. 1903, ii-385.

Trenton, N. J. Investigation and report on the garbage furnaces, by Randolph Hering. 1902, ii-96, 190, 197.

United States. List of plants in places of 3000 population and upwards. 1902, i-352.

Utilization of furnace heat at electric light plants in Chicago and Grand Rapids, Mich. 1901, i-120, *124, 191.

Wright furnace at Chicago electric lighting station. Utilization of garbage furnace heat. 1901, i-120, *124, 191.

Zurich, Switzerland. Horsfall refuse destructor. 1904, i-533.

Garbage disposal:

Boston:

Removal of works from Dorchester to Spectacle Island. 1901, ii-297, 308.

Review of ten years' experience. 1902, ii-96.

Burial after washing, Moline, Ill. By Edward Kittilsen, 1900, i-90.

Census Bulletin on the utilization of wastes and by-products. 1902, ii-64.

Chicago:

Financial difficulties. 1903, ii-58.

"Studying the art of garbage disposal." 1904, ii-219.

Detroit, Mich. Bids for collection and disposal. 1901, i-113, 201.

Economic and sanitary aspects of garbage disposal. By C. E. A. Winslow, 1903, ii-524.

Economic disposal of town's refuse. By W. F. Goodrich, 1901, ii-198.

Financial, political and sanitary phases of garbage disposal. 1901, i-120.

Moline, Ill. Washing and burying garbage. Furnaces rejected. Garbage collection. By Edward Kittilsen, 1900, i-90.

Montclair, N. J. Special committee suggests getting plans and estimates. 1904, i-79.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Garbage disposal: (Continued.)

New York:

Advertising for bids. Folly of short-term contracts. 1901, i-448.

Ashes, Disposal of. Bids and contracts. 1901, ii-297.

Bids on June 27, 1901. Litigation. Purchase of Barren Island plant considered unwise by J. C. Bayles. 1901, ii-8, 81, 88, 120, 308.

Remarks by Mayor Low, 1902, ii-48.

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Newark, N. J. Contract for collection and disposal of ashes and refuse. 1902, ii-105, 489.

Pittsburg, Pa. Consolidated American Reduction system. 1900, i-214.

St. Louis, Mo.:

Municipal blunders in advertising for bids. 1901, ii-308.

Report by municipal committee after visiting other cities. Figures for collection and disposal. 1904, i-33.

San Francisco, Cal. Legal decisions. By F. J. Mills, 1900, i-318, 325.

Transportation of garbage on street railways. 1903, ii-100.

United States:

Statistics for 1902. 1903, ii-412, 524.

Unsatisfactory condition of garbage disposal. By M. N. Baker, 1901, ii-116.

United States Garbage Reduction Co., Lynn., Mass., proposes to install the Day system in various cities. 1902, ii-127.

Garbage franchises in San Francisco, Cal. By F. J. Mills. 1900, i-318, 325.

Garbage furnaces. (See Garbage cremation.)

Garbage presses:

Barren Island, New York. Four-screw, three-speed type. 1900, i-*68.

Cleveland, Ohio. Four hydraulic presses. Boomer & Boschert Press Co. 1900, i-358.

Garbage reduction:

Allegheny, Pa. 1900, i-215.

Barren Island, New York:

Abolition of works. Legislative action. 1900, i-78, 185, 385; 1900, ii-26, 305.

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Bill to suppress plant declared unconstitutional by New York Court of Appeals. 1901, i-345.

Digesters and driers. 1900, i-*68.

Boston. Removal of plant delayed. 1903, ii-133.

Buffalo, N. Y. Merz system. Features of the new plant, especially the driers. 1901, ii-480; 1903, i-202.

Chicago. Experimental plant at 26th Street and Archer Avenue. Turner system. 1900, i-119.

Cincinnati, Ohio. Notes on plant. Simonin system. 1900, i-271.

Cleveland, Ohio. Driers of new Anderson type. 1900, i-*358.

Columbus, Ohio. 1900, ii-47.

Comparative merits of cremation and reduction. Garbage disposal in Chicago. By A. R. Reynolds, 1901, i-191.

Consolidated American Reduction system at Pittsburg, Pa. Legal decision. 1900, i-214.

Indianapolis, Ind. Historical sketch and description of reduction works. 1901, i-83.

Pittsburg, Pa. Consolidated American Reduction system. Law suits. 1900, i-214.

Simonin system in Cincinnati, Ohio. 1900, i-271.

Syracuse, N. Y. Holthaus system. 1900, ii-†247.

Turner process in Chicago. By A. R. Reynolds, 1901, i-191.

United States. List of plants in places of 3,000 population and upwards. 1902, i-352.

Washington, D. C. Five-year contract. 1900, i-401.

Garbage scow, Shelf-dumping, Havana, Cuba. By T. W. Allen, 1902, i-*244.

* denotes an illustrated article. † denotes an inset sheet.

Gas:

Cheapest in the world, Widnes, England. 1903, ii-193.

Distribution under high pressure:

Discussion at Western Gas Association. 1900, i-391.

Newton, Mass., Experience. By W. A. Learned, 1903, i-*406.

Phoenixville-Royersford, Pa. 20 lbs. pressure. Extracts from paper by F. H. Shelton. 1900, i-235.

St. Louis, Mo. 1904, i-79.

Future possibilities in gas manufacture and distribution. 1900, i-241.

Gas, electricity and acetylene compared for light, heating and power in Germany. By M. F. Schafer, 1901, i-476.

Hall (or Chisholm) electrical gas process. Abandoned in San Francisco and Oakland, Cal. By J. W. Chisholm, 1900, i-115, 281; A. C. Humphreys, 1900, ii-325.

Investigation of gas processes. By A. C. Humphreys, 1900, ii-325.

Leakage of gas:

Measuring leakage with portable gasometer. French invention. By Emil Guarini, 1903, ii-*483.

Reducing leakage at Tipperary, Ireland. By John Patterson, 1903, ii-339.

Manufacture of water gas and producer gas by Loomis process. 1901, ii-*170.

Oil-gas system:

Acme, for isolated plants. 1903, i-*111.

American Heat, Light and Power Co. Manufacture of combustible oxygen. Airified Gas Heating & Power Co. 1900, ii-250; 1903, i-110.

Price of gas in Peoria, Ill. City ordinance. 1903, i-421.

Production from wood. Riche invention. 1900, ii-163.

Pumping illuminating gas 124 miles to supply Paris, Project for. 1902, i-1.

St. Louis, Mo. High pressure distribution system. 1904, i-79.

Water gas:

Dellwik-Fleischer process. Compared with ordinary process. Use of gas in manufacturing industries. Use for lighting, heating and in gas engines. 1900, i-*236.

Loomis process of manufacture. 1901, ii-*170.

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Gas and oil engines:

Blast furnaces, gas as fuel:

Berlin-Anhalt Machine Co. 600-HP. engine, Oechelhaeuser system. 1900, ii-206.

John Cockerill Co. 600- and 700-HP. engines. 1900, ii-1, 49.

Statistics for European countries. 1900, i-313.

Blast furnace practice. By F. L. Grammer, 1904, i-230.

Cockerill, manufactured in the United States. 1900, ii-1, *49; 1903, ii-466.

"Combustion sight-hole," a device for examining the interior of cylinders while running. By W. T. Magruder, 1902, i-*385.

Commercial gas engine testing and a proposed standard of comparison. By W. P. Flint, 1904, i-549.

Compact gas engine, beam type. By C. H. Morgan, 1903, ii-516.

Comparative economy of gas engine and electric motor for small powers. 1902, i-167.

Cost of gas engine plant as compared with steam plant. 1901, ii-177.

Design, New principle of. By C. E. Sargent, 1900, ii-*415.

Diesel heat motor. Speed variations of Otto gas engine and the Diesel motor. 1900, ii-*83.

Differences in the construction of gas and steam engines. By P. Plantinga, 1903, i-67.

Dynamos driven by engines. Carnegie libraries, Pittsburg. Electric lighting plant. 1900, ii-377.

Four-stroke engines of John Cockerill Co. Use of blast furnace gas. 1900, ii-1, *49.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Gas and oil engines: (Continued.)

- Holland submarine torpedo vessels. 1901, i-212.
 Kerosene fuel. Tests. By H. F. Halliday and G. O. Hodge, 1903, ii-11.
 Mietz & Weiss. Tests of an oil engine with steam injection. 1904, ii-*230.
 Montezuma Copper Co., Nacozari, Sonora, Mexico. Producer gas and gas engine plant. John Langton, 1904, ii-96.
 Nash engines at the Buffalo Exposition. 1901, ii-*327.
 1,000-HP. direct-connected engine and gas compressor for pumping natural gas, Lancaster, Ohio. 1901, i-297.
 Otto-Crossley. Speed variations occurring during the cycles of the Otto engine and Diesel heat motor. 1900, ii-83.
 Power development with gas engines. By J. J. Flather, 1903, i-6.
 Principles and management of gas engines. By E. W. Roberts, 1903, ii-*240.
 Reliability, regulation and costs. Diagram of floor-space required. Curves of power. Cost. Comparison with steam engines and steam turbines. By William McClellan, 1904, ii-582.
 Secor internal combustion engine. By J. A. Secor, 1901, i-*238.
 Single-cylinder engine, Mather & Platt, Manchester. 1903, i-420.
 Standard of comparison proposed. By W. P. Flint, 1904, i-538, 549.
 Superiority of, for marine propulsion. 1903, ii-481.
 Tests, Efficiency, of a 125-HP. engine using natural gas, Lafayette, Ind. Diagram. By C. H. Robertson, 1901, i-414.
 2,300-HP. engine for high-pressure fire service pumping station, Philadelphia. 1902, ii-*144, 147.
 Two-stroke engines:
 500-HP. Koerting Bros. 1900, ii-207.
 600-HP. Oechelhaeuser system. Berlin-Anhalt Machine Co. First 600-HP. engine erected and operated. Later type constructed by Ascherleben Machine Co. Blast furnace gas. 1900, ii-†206.
 Velardena Mining & Smelting Co. Large gas engine plant. 1903, i-480.
 Westinghouse horizontal. 1903, i-183.
 Gas engineering, School of, needed. By A. E. Forstall. 1903, i-150, 216.
 Gas explosions in Boston, March 4, 1897. Boston Gas Company responsible. 1900, ii-273.
 Gas governors, Economy of. 1901, ii-366.
 Gasholders:
 Birmingham, England. 1901, i-12.
 Concrete tank at Hamilton, Ohio. 1901, i-313.
 Gas lighting:
 Baltimore, Md. Preliminary report of the Municipal Lighting Commission. 1900, i-192.
 Cost of street lights, in various cities of the United States. 1903, i-252.
 Gas literature, Card index to, Western Gas Light Association. 1902, i-425.
 Gas mantles, Deterioration of. 1903, ii-133.
 Gas pipe:
 Costs of construction and maintenance. Massachusetts Pipe Line Gas Co. System of daily reports and permanent record. By W. W. Cummings, 1902, ii-*252, 264.
 Electrolysis. (See Electrolysis of pipes.)
 Insulated joints to prevent electrolysis, North Shore Gas Co., Waukegan, Ill. 1902, i-513.
 Wrought iron pipe advocated by G. L. Cabot of Boston. 1902, i-381.
 Gas plants:
 Depreciation of. 1902, i-425.
 Paris. Estimated cost of new works. 1902, i-267.
 Gas producers:
 Efficient working of gas plants for gas engines. By J. E. Dowson, 1901, ii-439.

* denotes an illustrated article. † denotes an inset sheet.

Gas producers: (Continued.)

Loomis-Pettibone Gas Machinery Co. at plant of Montezuma Copper Co., Nacozari, Sonora, Mexico. By John Langton, 1904, ii-96.

Loomis water gas and producer gas process. 1901, ii-*170.

Mond process of making producer gas. 1901, ii-*170.

Gas rates and a franchise tax. Discussion at Society convention. 1902, ii-328, 336.

Gas reservoir, Seamless. German exhibit at Paris Exposition. 1900, ii-48.

Gas scrubber for gases from garbage reduction works, Barren Island, New York. 1900, i-*68.

Gas works, Municipal ownership of. By A. E. Forstall, 1903 i-150, 212, 216.

Gasket, Combination metallic, for flanged joints. Lead and copper ring. 1901, ii-*346.

Gasoline motor, Light weight. 1903, i-480.

Gasometer, Portable, for measuring leakage of gas from mains. By Emil Guarini, 1903, ii-*483.

Gatehouses:

Massena, N. Y., St. Lawrence Power Co. Plans for controlling ice and floating trash. 1901, i-131.

Screens and screen lifters, Metropolitan Water-Works. By C. W. Sherman, 1900, ii-*218.

Wachusett dam, Boston, Mass. Details of chambers. By A. D. Flinn, 1900, ii-*175.

Gates:

Arkansas Valley system of irrigation, Colorado. Canal headgate. By W. P. Hardesty, 1902, ii-405.

Balanced gates with wickets. Guthrie design. Controlling works of Chicago drainage canal. 1901, i-*2.

Drawbridge gate. Tyrrell design. Interlocking mechanically-operated gate. By H. G. Tyrrell, 1900, ii-*452.

Flood gate in street tunnel, Montreal, Canada, to keep out water and ice of St. Lawrence River. 1900, i-*336.

Grade crossing gate, Pipe-connected, Wilson design. 1900, ii-*140.

Grand Valley canal, Colorado. Masonry and steel head-gate. By C. T. Johnston, 1903, ii-*140.

Iron or wooden lock gates. Cost of construction and maintenance. Summary of reports presented to International Navigation Congress. 1902, ii-289.

Sault Ste. Marie canal, Mich. Stoney sluice gates. 1902, ii-*227.

Sewage gates, Pittsfield, Mass. Intermittent filtration plant. 1902, i-*339.

Gayley laboratory, Lafayette College, Easton, Pa. 1902, i-*291.

Gearing:

High-speed toothed gearing. By James Christie, 1901, i-*155.

Speed-changing gear, Dieterich. 1900, ii-*338.

General Electric Co., Financial report of. 1903, i-388, 452.

Generators. (See Electric generators.)

Genoa, Italy, View of. 1904, i-*273.

Geodetic astronomy, Books on. 1903, i-Eng. Lit. Sup. Feb. 19.

Germany, Municipal notes in. 1904, i-*533, *572.

Girders:

Bending moment in a circular girder. By G. P. Starkweather, 1900, ii-200, 335.

Capacity of steel girders in foot-pounds of bending moment. Table. By F. L. Batchelder, C. T. Morris, 1903, i-351, 411, 454.

Concrete-steel, Ingalls Building, Cincinnati, Ohio. 1903, ii-*91.

Concrete-steel with open webs, for Purfleet bridge, England. 1904, ii-*506.

Coverings, Fire test of, by British Fire Prevention Committee. 1900, i-201.

Defects in old English girders, cast and wrought iron. 1901, i-8, *16.

"1900, ii—112" means "Year, 1900, second volume, page 112."

Girders: (Continued.)

Iron girders riveted, in old building in New York. 1903, ii-*214, 223.

Plate girders:

Buckling resistance, Table for determining, of web plates. By R. B. Woodworth, 1900, i-211.

Drip apron or fan for plate girder bridge, Hartford, Conn. By H. R. Buck, 1904, i-*276.

Large plate girder railway bridges on the Erie R. R. and on the Erie, Alliance & Wheeling Ry. 1904, i-*167.

Safety of a girder exposed to heat. By L. Colwell, 1903, i-*548.

Transportation of girders:

Canadian Pacific Ry. 130-ft. lattice girder. 1900, i-*74.

Chic., Bur. & Quincy Ry. Bridge span supported on cars. 1900, i-*21.

Chic. & West. Ind. R. R. 1900, i-297.

Hocking Valley Ry. Three 125-ft. spans moved by rail. 1900, ii-*344.

Keystone Bridge Works, Pittsburg. Details of bracing and bolster for supporting girder. 1900, i-*58.

Transportation of railway bridge girders. 1904, i-*167.

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Girouard, Sir Percy, Biographical sketch of. By J. T. Chartrand, 1903, ii-*476.

Glass:

Diffusion of light by glazing and glass of different kinds. Tests by Boston Manufacturers' Mutual Fire Insurance Co. 1900, ii-216.

Experiment on the diffusion of light through prismatic and ribbed glass windows by C. L. Norton for the Associated Factory Mutual Companies of New England. 1901, i-33.

Fire tests of casements by British Fire Prevention Committee. 1900, i-13.

Luxfer prism, Fire tests of, in Boston. 1903, ii-387.

Wired glass and prism glass frames. 1901, i-456.

Gold:

Corea. Notes on mining operations. 1903, i-245.

Future production of gold. By N. S. Shaler, 1901, i-161, 210.

How to pan gold from gravel. By H. S. Munroe, 1903, i-149.

Metallurgical treatment of ore by the Homestake Mining Co. By C. W. Merrill, 1903, ii-269, *271.

Placer gold deposits in Alaska. Reports of engineers. 1902, ii-483.

Production in North America; its geological derivation and probable future. By Waldemar Lindgren, 1902, ii-207.

Spongy (?) gold and its resistance to amalgamation. Experiments by Miguel Bustamante, Jr. 1903, i-15.

Witwatersrand gold fields of South Africa:

Future of. By John Hays Hammond, 1901, ii-478.

Underground hoisting problems. By A. W. K. Pierce, 1903, ii-51.

Gold dredging:

New Zealand. By Gilbert Winslow, 1904, i-224, 247.

Oroville, Cal. Prospecting and valuing dredging ground with a well-driller. By N. B. Knox, 1903, ii-94.

Governors:

Brown Corliss engine. 1904, ii-*324.

Gas governors, Economy of. 1901, ii-366.

Hydraulic governors. Speed regulation in water power plants. By J. W. Thurso, 1903, i-26.

Murray Corliss engine. 1904, ii-*323.

Water wheel governors:

Electric speed controller attachment. Lombard Co. 1903, i-62.

Lombard governor controlling two water-wheel units, Manchester, Conn. By E. E. Boardway, 1903, i-*249.

Replogle "differential relay." 1902, ii-*409.

Governor's Island, N. Y. Harbor, Plans for enlarging island. 1901, i-57.

Grade crossing gates, Pipe-connected, Wilson design. 1900, ii-*140.

* denotes an illustrated article. † denotes an inset sheet.

Grade crossings:

- Chicago. Accidents. 1901, ii-17.
 Cincinnati. Proposed abolition under new State law. 1902, i-440.
 Cleveland, Ohio. Elimination of steam and electric railway crossings.
 Report of special committee of Cleveland Chamber of Commerce.
 1900, i-137; 1901, i-98.
 Detroit, Mich. Abolition of crossings. 1900, i-184.
 Discussion of the grade crossing problem. By L. F. Loree, 1900, i-95.
 Electric and steam railways:
 Cleveland, Ohio. Crossing to be removed. 1900, i-137.
 Indiana and Illinois crossings. 1904, ii-219.
 Oshkosh & Neenah Electric Ry. and Northwestern Ry. 1900, i-*219.
 Literature on the dangers of grade crossings. 1903, i-Eng. Lit. Sup.
 Jan. 15.
 Massachusetts. Treatment of subject in Governor's message. 1902, i-17.
 Newark, N. J. Collision of street car and train. 1903, i-185, 194, 300.
 St. Louis. Accident, Sept. 3, 1904. Electric car wrecked by train. 1904,
 ii-219.
 Texas. Law to regulate crossings. Effect of State Law for protection
 of crossings. Requirements and recommendations for interlock-
 ing systems. 1901, ii-113; 1902, ii-42.
 Washington, D. C. Notes on report made to Senate by Commissioners.
 1900, i-105, 137.
 (See also Signals and signaling; Track elevation.)

Grades, Railway:

- Grade compensation for curvature on South Australian railways. By A.
 B. Moncrieff, 1902, i-505.
 Improvement of railway grades and alignment. Limiting grade. Virtual
 grades. Report of American Railway Engineering and Mainte-
 nance of Way Association. 1902, i-247, 248.
 Investigation as to virtual grades, Canadian Pacific Ry. By A. C. Dennis,
 1900, ii-*360.
 Measurement of railway grades. Computing resistance due to steep
 grades. Meaning of per cent. By J. L. Campbell, H. P. Gillette,
 1900, ii-373, 410; 1901, i-30.
 Momentum grades. Comments on their literature and their probable
 future use. By W. D. Taylor, C. F. Allen, 1904, i-410, 470.
 "Plunging a grade". "Plunge rod". By John McNeal, Jr., T. R. Smith,
 1901, i-286, 306, 321.
 Virtual grades. Report at American Railway Engineering and Mainte-
 nance of Way Association. 1902, i-247.

Grades, Sewer, Laying out with a transit. By William Cain, 1901, i-418.

Grading:

- Hydraulic grading of river bank, Missouri River, Chicago & Alton Ry. By
 W. R. DeWitt, 1902, i-*450.
 Railway roadbed and yards. Report by American Railway Engineering
 and Maintenance of Way Association. 1901, i-199.
 Railway specifications for grading. 1903, i-260.
 Specifications for Arizona drainage canal and drawn by United States
 Geological Survey. 1904, i-Cons. News Sup. Jan. 7.
 (See also Earthwork; Excavation.)

Grading and steam excavating machine, carrying a plow and a conveyor. Bun-
 nell Machinery Co. 1901, ii-*98.

Graduate. (See Engineering schools.)

Grain elevators:

- Buffalo, N. Y.:
 Collapse of Ontario grain elevator Oct. 30, 1904. 1904, ii-406.
 Fall of traveling elevator leg. 1902, i-*424.
 Derrick elevator in London harbor. 1904, ii-*317.
 Duluth, Minn.:
 Failure of concrete steel bins, Dec. 12, 1900. 1900, ii-*438.
 "1900, ii-112" means "Year, 1900, second volume, page 112."

Grain elevators:

Duluth, Minn.: (Continued.)

Peavey concrete elevator. Second failure April 16, 1903. 1903, i-*396, 432.

Fireproof elevators. Loaning money upon grain without insurance, Minnesota. 1901, i-297.

Fireproof elevators at Duluth, Minneapolis, Chicago, Cleveland and Buffalo. Construction details. Report to Montreal Harbor Commissioners. By John Kennedy. 1901, ii-40, 42.

Ft. William, Canada. Fire wrecked part of steel tank plant. 1902, i-381, 449.

Gt. Northern Ry., West Superior, Wis. Details of construction and operating machinery. Steel elevator. 1901, ii-†210.

Hickman, Ky. Roller-chain conveyor on an incline for transferring grain from boats to cars. 1901, ii-*76.

London harbor elevators, Various types of. Details of derrick elevator. 1904, ii-*317.

Montreal elevators. Building law. 1900, i-1.

Pneumatic elevators in London harbor. 1904, ii-*317.

Port Arthur, Ontario, Canadian Pacific Ry. 1901, ii-185.

(See also Bins.)

Grain pressures in deep bins:

Buenos Aires. Eckhardt Lufft, 1904, ii-*531.

Pressures in deep bins and the strength of wooden bins. Experiments in Montreal. By H. T. Bovey, 1904, ii-32.

Tests. By J. A. Jamieson, H. E. Vautelet, William Cain, 1904, i-224, *236, *403, 451.

Granite a mineral. 1902, ii-474; 1903, i-245.**Graphical methods:**

Approximate method of dividing an arc into any number of equal parts. By R. H. Moore, 1900, ii-*28.

Calibration of irregular tanks. By Arnold Emch, 1903, i-*158.

Car record system. McNamara invention. Report on use of system by Canadian Pacific Ry. 1900, i-*91.

Hanna angle multisector. 1904, i-*450.

Record of organization, of construction and maintenance of way department. International Ry. Co., Buffalo. 1902, i-409.

Skew structural work. By C. A. P. Turner, 1900, i-†107, †126, 146; By C. G. Wrentmore, 1904, i-28, 161.

Grasses as sand and soil binders. 1902, i-333, *341; 1902, ii-65, 329.

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Gravel digging and screening plant combined. 1904, i-*444.

Gravels, Road-building. (See Roads, Earth.)

Gravity tramways. (See Inclines.)

Great disasters of the world. 1902, i-392.

Great Lakes:

Changes in the levels of the lakes, 1860-1901. Chart. 1902, i-278.

Controlling the levels of. 1900, i-9, *11, *12, 26, 40, 192, †198.

Development of commerce of the Great Lakes. By Alfred Noble, 1903, i-532.

Lake Erie, Wind velocity and fluctuation of water level of. Report by A. J. Henry. 1902, ii-72.

Low-water reference planes, New standard. 1902, i-125.

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Great Plains, Uplift under. 1903, ii-463.

Great Salt Lake, Utah. Embankment and trestle across the lake, part of the Southern Pacific Ry.'s Ogden-Lucin cut-off. By C. W. Arthur, 1902, ii-*442.

Green, Andrew H., Civic museum as a memorial to, proposed. 1904, i-588.

Greene, Charles Ezra, Biographical sketch of. 1903, ii-387.

Greene and Gaynor. (See Carter, Oberlin M., Contractors.)

* denotes an illustrated article. † denotes an inset sheet.

- Greenhouse, Largest in the world, Edgley, Pa. By A. C. Johnston, 1901, ii-*459.
- Grinding machine, Yankee. Fuller Mfg. Co. 1900, i-*148.
- Ground water. (See Water supply, Underground.)
- Grouting, Cement:
- Dams and cement grouting. J. C. Temple, J. W. Hays, A. R. Eldridge, W. D. Taylor, J. H. Harlow, O. H. Briggs, B. H. Hardaway, R. L. Johnson, 1902, i-52, 71, 108, 115, 156, 176, 233, 312.
 - Foundations. Injection of cement grout into sand or gravel. By J. T. Norton, A. R. Eldridge, 1902, i-*35, 113, 115.
 - Piles, Protection by cement grouting. By H. F. Wilson, Jr., 1902, i-*176.
- Grubbing and clearing, Methods of paying for. By J. T. Dodd, 1903, ii-592; By T. H. Mather, Woolsey Fennell, G. W. Stadly, 1904, i-38, 63; Cons. News Sup. Jan. 14.
- Guard rails:
- Curve guard rail. Standards in the United States, Canada and Mexico. 1900, ii-142, 149, 215.
 - Latimer, Use of, on American railways. 1903, i-257.
 - Step chair and brace, Southern Pacific Ry. 1901, i-*36.
- "Gumbo" in earthwork classification. By P. E. Green, C. H. Miller, 1904, i-284, 452, 494.
- Gun barrel blanks, Drop test. Swedish exhibit at Paris Exposition. 1900, ii-*48.
- Gunpowder:
- Electric powder-thawer. 1902, i-405.
 - History of its production. By Rear-Admiral Charles O'Neil. 1902, ii-485.
 - Progressive combustion of gunpowder and the credit for its development. By R. C. Schuepphaus, Hudson Maxim, T. A. Hill, 1900, i-*275, 426.
- Gunshields, Test of, at Bethlehem. 1902, i-61.
- Gun sight, Grubb collimating. 1904, ii-*218.
- Guns:
- Breaking up 15-inch Dahlgren guns at Mare Island Navy Yard. By F. H. Green, 1901, ii-*240.
 - Brown segmental, Failure of. 1901, i-257; 1901, ii-321.
 - Destructive power of guns of modern battle-ship. Experiments by British Admiralty. 1900, ii-173.
 - Developments in ordnance and armor. By J. F. Meigs, 1901, ii-385.
 - Development of guns and projectiles in the United States, 1862-1902. By Rear-Admiral Charles O'Neil, 1902, ii-451, 485.
 - Driggs semi-automatic, Tests at Indian Head. 1900, i-185.
 - Electro-magnetic gun invented by Birkeland. 1902, i-387.
 - Explosion of 12-inch gun on the "Iowa". 1903, i-337.
 - Gathmann 18-inch, Test of, at Sandy Hook. By Hudson Maxim, 1901, ii-357, 377, 388, 434.
 - "Long Cecil", Construction of. By Edward Goffe, 1900, ii-*110.
 - Naval tactics. Marksmanship. Record in the British Navy. 1902, ii-455.
 - Non-recoiling magazine rifle. Inventor, S. N. McClean. 1900, ii-69.
 - Pneumatic gun of the Dynamite Gun Co. Test. 1901, ii-357, 441.
 - Resistance of iron to destruction by sea air. Cannon used as fog signal. By J. H. G. Wolf, 1902, i-*437.
 - 16-inch breech-loading rifle, United States, Description of. 1901, ii-*50.
 - 16-inch gun tested, Jan. 17, 1903, Sandy Hook, N. J. 1903, i-69.
 - 10-inch wire gun, Brown system, tested at Sandy Hook. 1903, ii-113.
 - Test of guns vs. armor plate at Eskmeals. Vickars guns and Johnson capped projectile. 1902, i-469.
 - 12-inch gun destroyed in test at Sandy Hook. 1903, i-89.
- Gusset-plates in roof trusses, Design of. 1903, ii-60.
- Gutters:
- Diagram for determining size of. By Emmet Steece, 1902, i-309.
 - Gutter in center of street, Trinidad, Cuba. 1903, i-505; 1903, ii-13.
- Gypsum, Notes on. 1902, i-354.
- "1900, ii-112" means "Year, 1900, second volume, page 112."

H.

Hailstorms, Prevention of:

Acetylene explosions, in France. 1901, i-113.

Cannon, Use of, in French experiments and in Switzerland. 1900, ii-164; 1901, i-*283; 1902, i-334.

Hammers. (See Pneumatic tools; Steam hammers.)

Hand cars. (See Cars.)

Hand-hole covers, English design for. 1900, i-*248.

Hangers. (See Joist hangers.)

Harbors:

Cumberland Sound, Georgia and Florida. Improvement work under Capt. Gillette. By W. M. Smith, J. P. Allen, J. H. Bacon, 1903, i-234, *239, 277, 370.

Depth of harbors in America. 1901, ii-197.

Duluth, Minn. Concrete pier superstructure for ship canal entrance. Mixing, molding and laying of concrete blocks. 1900, ii-†56.

Durban harbor, Natal. Improvements. 1901, ii-441.

Manila, P. I. Improvements. Naval coal storage plant. 1901, i-425. 1902, ii-*91.

Montevideo, Uruguay. Improvements. 1900, ii-1, 205.

New York:

Changes in harbor line considered by Harbor Line Board. 1900, i-313.

Dredging work. 1903, ii-1.

Excavation of Ambrose channel. Dredges and their operation. Report of H. N. Babcock. 1903, i-161.

Freight traffic in. 1904, i-176.

Ship yard and dry dock project on reclaimed ground between Bedloe's and Ellis Islands. 1901, i-241.

(See also Docks, New York.)

Savannah frauds. (See Carter, Oberlin M.)

Hardpan:

Difference between hardpan and rock. 1904, ii-424.

Lawsuits that have arisen over hardpan. 1904, i-Cons. News Sup. Feb. 11.

Harrow used on macadam road repairs. Albion, N. Y. By H. P. Gillette, 1901, ii-*206.

Haskin, Dewitt C., originator of the Hudson River tunnel. 1904, i-343.

Haswell, Charles Haynes, Biographical sketch of. Dinner by Engineers' Club on his 95th birthday. 1904, i-492, †509.

Haul diagram for computing overhaul and free haul on railways. By F. C. French, 1904, i-101.

Haulage, Cost of wire rope, in English coal mines. 1902, ii-386.

Hauling by wagons:

Cost of haulage by horses and road improvement. By H. P. Gillette, 1901, i-433.

Glens Falls, N. Y. 15-ton load on three wagons. By C. E. Parsons, 1904, i-62.

Spier Falls dam, 14-ton load. 1903, i-*554.

Traction on wagon roads. Experiments on different roads and pavements. By I. O. Baker, 1902, i-*182, 365.

Havana, Cuba:

Disinfection of buildings, Compulsory. 1903, i-78.

Engineering work in the city of Havana. From Report of Gen. Ludlow. 1901, i-†90.

Franchises in Cuba and the Foraker resolution. 1901, i-396.

Yellow fever and mosquitoes. 1901, ii-129, 452.

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Hawshaw, John Clarke, his address before the Institute of Civil Engineers. 1902, ii-527.

Headgates. (See Gatehouses; Gates.)

* denotes an illustrated article. † denotes an inset sheet.

Headlights. (See Locomotive headlights.)

Heat, Electric, Possibilities of, as limited by the cost of production. By A. D. Adams, 1900, ii-131.

Heat resistance, the reciprocal of heat conductivity. By William Kent, 1902, ii-475, 543.

Heater for concrete work, N. Y. C. & H. R. R. R. By G. W. Lee, 1903, i-*247.

Heating and ventilation:

Air ducts, Dangerous. 1900, i-87.

Air heating with radiators and a closed piping system. By G. M. Aylsworth, 1903, ii-*111.

Atomizer for introducing moisture in furnace-heated houses. By W. E. Saunders, 1904, i-*63.

Blower systems, Condensation of steam in. Results of tests. By R. C. Carpenter, 1900, i-*72.

Central stations:

Atlanta, Ga. 1901, i-75.

Bloomington, Ill. Concrete conduit construction for Consumers' Heat & Electric Co. 1901, i-*280.

Hot water vs. steam heating. By D. F. McGee, J. F. Porter, P. H. Korst, C. R. Munsell, 1902, i-505.

Indianapolis, Ind. By W. K. Eldridge, 1903, ii-419, 456.

Notes. Advantages of the steam system. By W. H. Bryan, 1901, i-109.

Owatonna, Minn. Hot water system. 1902, i-67.

Report of Committee of National Electric Light Association. 1903, i-506.

Stations in places of 3,000 population and upwards in the United States. Table. 1902, i-231.

Steam heating from a central station. By F. B. Hoff, 1904, i-68.

Toledo, Ohio. Hot water heating. By H. T. Yaryan, 1900, i-*321.

Cooling and purification of air for office buildings. 1903, ii-24.

Dwelling house ventilation. 1904, i-85.

Exhaust steam heating. Suggestions. Connection of exhaust pipe to riser. Pressure reducing apparatus. By W. E. Wood, 1904, i-*332.

Exhaust steam systems. Losses from back pressure. By R. L. Gifford, 1902, i-453.

Furnace heating for school houses, Boston experience in. 1900, i-169.

Furnace pipe, Size of. Table compiled by W. G. Snow. 1900, i-238.

Greenhouse heating. 1904, i-86.

Hot water heating apparatus, Volume of water in. By W. M. Mackay, 1901, ii-37.

Hot water heating from a central station, Toledo Heating & Lighting Co., Toledo, Ohio. By H. T. Yaryan, 1900, i-*321.

Hot water heating with accelerated circulation. Reck system. Table of heat-transmission coefficients. 1904, i-85, *102.

Moisture in furnace-heated houses. By G. A. Loveland, 1903, ii-Eng. Lit. Sup. Dec. 10, 525; 1904, i-Eng. Lit. Sup. Jan. 14, 86, 376, 383; By H. F. Bishop, 1904, ii-234.

Steam heating:

Low-pressure steam-heating system which proved defective in operation. By John Gormly, 1903, ii-83.

"Thermograde" system. 1903, ii-*80.

Symphony Hall, Boston. Nearly perfect system of warming or cooling auditorium. 1901, i-104.

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Hecla Portland Cement & Coal Co. Plant and buildings at Bay City, Mich. 1904, i-*243.

Henck, John Benjamin, Biographical sketch of. By G. F. Swain, 1903, i-*160.

Hennebique patents for reinforced concrete, Validity of. By B. Baffry, 1904, i-403.

Hering, Carl, Biographical sketch of. 1901, i-44.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Hermany, Charles, Biographical sketch of. 1904, i-†89.

Hewitt, Abram Stevens, Biographical sketch of. 1903, i-*80, 106.

Hoisting apparatus:

Compressed air plant driven by electric motor, Reheating air for. By C. O. Poole, 1902, ii-168, *175.

Efficiency of hoisting tackle. Tests by the erecting department of the American Bridge Co. By S. L. Wonson, 1903, i-*520.

Electric hoists:

Cableway and hoist for distributing pipe along trench. Redlands Electric Light & Power Co. By E. Duryee, 1903, i-*134.

Continuous system of electric hoist in mining shaft of the Consolidated California & Virginia Mining Co. By L. M. Hall, 1902, ii-133.

Traveling hoist for coal handling plant, Milwaukee Electric Railway & Light Co. 1904, i-*183.

Unreliability of the electric motor for hoisting purposes. By C. O. Poole, 1902, ii-168, *175.

Furnace hoist and stock distributor. Brown Hoisting & Conveying Co. 1900, i-254.

Hooks, Hoisting:

Experiments on the strengths of different makes at Lewis Institute, Chicago. By J. L. Bacon, 1903, i-*574.

Lifting concrete blocks, on breakwater at Welland canal entrance. 1902, i-*384.

Mine shafts. Water hoisting in the Pennsylvania anthracite region. Methods and cost. By R. V. Norris, 1903, i-*315; 1904, i-*208.

Novel chain ammunition hoist. 1903, i-*378.

Pneumatic motor hoist. General Pneumatic Tool Co. 1903, i-*394.

Sidewalk hoist, Double plunger. Prudential buildings, Newark, N. J. By C. L. Duenkel, 1903, i-*123.

Underground hoisting problems on the Witwatersrand. By A. W. K. Pierce, 1903, ii-51.

Weehawken inclined railway, New Jersey. Automatic stop motion and magnetic brake for hoisting motors. By C. L. Duenkel, 1902, ii-†306.

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Hoisting engines:

Bucyrus dipper dredge. Operation and special features. 1900, i-*138.

Mietz kerosene engine. 1904, i-375.

Mine engines, Traversing carriage. English. 1900, ii-49.

Throttle-closing mechanism, Automatic. Mine engine at Oliver Iron Mining Co., Ely, Minn. 1903, ii-*450.

Types of engines. Calculation of the cylinders. By E. B. Durham, 1902, ii-*318.

Hoisting plants:

Determining the size of plants. By E. B. Durham, 1902, ii-*318, 450.

Oliver Iron Mining Co., Ely, Minn. 1903, ii-*449.

Hoisting towers, Steel, for hoisting coal. By H. G. Tyrrell, 1901, i-*386.

Holland, Municipal notes in. 1904, i-*574.

Honolulu, Determining the longitude of, 1555-1903. By J. F. Hayford, 1903, ii-414.

Hooks. (See Hoisting apparatus.)

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Horse power, Illustration of (?). By H. M. Kerschner, 1904, ii-*505, 520.

Horseshoeing a "close" profession in Illinois. 1902, ii-190.

Hose:

Air brake hose specifications. 1901, ii-7; 1904, ii-9.

Armored hose. Rubber hose wrapped by two thin, flat steel bands. 1900, i-*323.

Flexible metallic hose:

Car heating pipe. 1903, ii-*582.

Witzenmann hose for steam and other connections. 1902, i-*277.

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* denotes an illustrated article. † denotes an inset sheet.

Hose couplings:

- Climax coupling for armored hose. Street invention. 1900, i-*323.
- Standard number-code suggested for fire-hose. By C. E. Loetzer, G. S. Curtis, 1904, ii-67, 92.
- Hot well for condenser plant at power station of St. Louis Transit Co. 1902, i-*271.
- Hot well used as an oil extractor by Swift & Co., St. Joseph, Mo. By A. H. Eldridge, 1903, ii-*11.
- Hottest places in the world, Table of. 1902, ii-89.
- Humidity, Measurements of. (See Heating and ventilation, Moisture in furnace-heated houses.)
- Humidostat for controlling humidity in buildings. By W. S. Johnson, 1904, i-*383.
- Humphreys, Alexander C., Inauguration of, as President of Stevens Institute. 1903, i-*146.

Hydrants:

- Artistic fire hydrants. 1903, ii-182.
- Fire hydrant with a balanced valve. Ludlow Valve Mfg. Co. 1902, ii-*432.
- Roof hydrants, Experience with, in Philadelphia fire. 1900, i-75.
- Specifications for mill hydrants. National Fire Protection Association. 1901, i-455.
- Standard number-code for hydrant and fire-hose couplings suggested. By C. E. Loetzer, G. S. Curtis, 1904, ii-67, 92.
- Test of fire hydrant by New York Department of Water Supply. 1904, ii-366.
- Hydraulic diagrams. Schuerman's paper before the Engineering Association of the South. 1903, i-501, 568.
- Hydraulic diaphragms used in grain-pressure tests in full-size bins. By J. A. Jamieson, H. S. Vautelet. 1904, i-224, *236, *403.
- Hydraulic engineering, Nomenclature, Uniform. By J. W. Thurso, 1903, i-30.
- Hydraulic excavation. (See Earthwork.)

Hydraulic formulas:

- American and European formulas for the flow of water over weirs. By F. D. Olmsted, J. W. Thurso, 1903, i-370.
- Calculation of flood discharge in Rock Creek, Washington, D. C. By W. J. Douglas, 1902, ii-534.
- Comparison of various formulas for flow of water in smooth pipes. Flamant formula considered most suitable for design of ordinary distributing system. Diagram based on formula. By C. B. Stewart, 1901, i-262.
- Comparison of various formulas for flow of water in clean cast iron pipes. Table. By F. S. Bailey, J. C. Trautwine, Jr., E. S. Gould, I. P. Church, Clemens Herschel, 1901, ii-98, 178, 332, 476.
- Darcy formula. Flow of water through clean and through dirty pipes. By E. S. Gould, 1900, ii-166.
- Experiments on the flow of water over dams, by students at Thayer School of Civil Engineering. 1900, ii-*207, 232.
- Flood discharges and values of "n" in Kutter's formula. By R. H. Anderson, 1904, ii-103.
- Measurement of the flow of water in the Sudbury and Cochituate aqueducts by a combination of current meter and flow formula. By W. W. Patch, 1902, i-*488.
- (See also Photo-pitometer.)

- Notes on lost head in water supply systems. By A. P. Folwell, 1902, i-303.
- Rational and empirical features of flow of water in pipes. By I. P. Church, Clemens Herschel, 1901, ii-332, 476.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Hydraulic formulas: (Continued.)

Storm flows from city areas and their calculation. Kuichling's method with variations. By E. W. Clarke, 1902, ii-386.

Wasteways, Formulas for the length of. By E. S. Gould, J. P. Frizell, J. L. Campbell, H. P. Gillette, C. H. Tutton, E. L. Gould, 1901, ii-89, 161, 266, 362, 430.

(See also River gagings.)

Hydraulic jacks. (See Jacks.)

Hydraulic machinery, Diagrams for estimating. By F. B. Kleinhans, 1903, ii-*362.

Hydraulic plants, Safety devices for. Valves and blow-off holes. By F. B. Kleinhans, 1904, i-216.

Hydraulic power. (See Water power.)

Hydraulic presses:

Discussion of hydraulic presses. By G. L. Gillon, 1901, i-*95.

Press for compressing steel ingots by wire drawing at St. Etienne works, France. 1902, ii-*262.

Hydraulic shock. (See Water pipe, Hammer in.)

Hydraulic tools in railway service. By G. L. Gillon, 1901, i-*94.

Hydraulic works, Worthington, at Harrison, N. J. 1903, ii-*584.

Hydraulics:

Problem in. 1901, ii-*9.

Russian studies of flow of rivers. Experiments by Leliavsky. 1904, ii-183.

Hydrographic chart engraving machines in the Japanese Navy. 1901, ii-*163.

Hydrographic survey. (See Surveys.)

Hydrostatic pressures, High. Effect of high pressures upon bacteria in milk and other liquids. Tests at West Virginia Agricultural Experiment Station. By F. H. Stillman, 1900, ii-230, *236.

Hydrostatics, Problem in. 1903, ii-*544.

I.

Ice-bearing machine at Ottawa, Ontario. 1904, i-*491.

Ice borings. By W. B. Landreth, G. A. Taylor, 1904, i-160, 203, 282.

Ice supply of Boston investigated by Board of Health. 1902, ii-102.

Illinois Railroad Commission, Duties of the consulting engineer to. By F. G. Ewald, 1903, i-100.

Illinois Society of Engineers and Surveyors, Conventions. 1900, i-88; 1901, i-87, 96; 1902, i-97; 1903, i-100; 1904, i-86, 110.

Impact testing machine at Purdue University. By W. K. Hatt and W. P. Turner, 1901, i-*3, 9.

Impact tests. (See Iron and steel, Tests.)

Incline railways. (See Cable railways.)

Inclines:

Automatic, for hoisting mine cars, Magnolia, Ohio, for National Fireproofing Co. 1901, ii-*354.

Gravity incline at the Antonio mine in Cuba. By E. M. Holmes, 1904, i-*446.

Hoisting freight and other material. By F. B. Freeman, A. S. Hobby, 1903, i-253, 302, 369.

Indexing:

Card index system in the drawing room of the Chief Engineer's office of the Pittsburg & Lake Erie R. R., at Pittsburg. By R. P. Forsberg, 1902, i-*2.

City engineer's office systems. By F. W. Dalrymple, 1901, ii-218; By A. H. Pratt, 1903, i-356.

Indexing atlas sheets of the United States Geological Survey. 1904, i-304.

Indexing hand-books by cutting margins. By M. C. Couchot, 1903, ii-369, 505.

Railway maps and drawings. By R. C. Vial, 1901, ii-147.

* denotes an illustrated article. † denotes an inset sheet.

Indexing: (Continued.)

- Rules to be observed in making indexes. 1903, ii-Eng. Lit. Sup. Aug. 20,
(See also Records.)
- Indiana Bridge Co., Drawing office record of work. 1902, ii-72.
- Indiana Engineering Society, Conventions. 1900, i-104; 1901, i-140; 1902,
i-124; 1903, i-76; 1904, i-57.
- Indianapolis, Ind. Engineering features of the city. 1903, ii-386.
- Indicator, Steam engine, Richards, and the Allen engine. By C. T. Porter,
1900, ii-394.
- Industrial education in America. 1900, ii-33.
- Industrial railway at the Sturtevant foundry, Hyde Park. 1903, ii-*417.
- Injector, Lunkenheimer automatic. 1900, ii-*392.
- Inspection of bridges and culverts, Method of making annual. Report at As-
sociation of Railway Superintendents of Bridges and Buildings.
1903, ii-394.
- Inspectors, Responsibilities of. 1904, i-613; 1904, ii-43.
- Inspectors of cast-iron water pipe, special castings and stop valves, Philadel-
phia, Instructions to. 1903, i-527.
- Institution of Civil Engineers, President J. C. Hawkshaw, Address by. 1902,
ii-527.
- Insulation, Electric:
- Energy loss in commercial insulating materials when subjected to high
potential stress. By C. E. Skinner, 1902, ii-5.
 - Insulating materials; a field for the chemist. By Max von Reckling-
hausen, 1903, i-375.
 - Notes on insulators. By F. A. C. Perrine, 1902, ii-135.
 - Recommendations concerning electrical and mechanical specifications of
trolley-line insulators. By Samuel Sheldon and J. D. Keiley,
1903, ii-*109.
 - Tests of insulators on a 16-mile, 80,000-volt experimental electric trans-
mission line at Kern River, California. By A. C. Balch, 1904,
ii-204, 219.
- Insulation, Heat. Conducting and resisting values of different insulating
materials. By William Kent, 1902, ii-475.
- Insurance. (See Fire insurance.)
- Insurance Engineering Experiment Station, Boston, Review of first report.
1902, ii-1, 169, 214.
- Intake cribs on Chicago water supply tunnels. 1900, ii-310.
- Intake tunnels. (See Tunnels, Water-works.)
- Integrator, Mechanical, used in connection with a spring dynamometer, C., B. &
Q. R. R. By M. H. Wickhorst, 1900, ii-*407.
- Interchange traffic. (See Car interchange.)
- Interest rate in the United States. 1900, ii-312.
- Interlocking. (See Signals and signaling.)
- International Association for Testing Materials. (See American Society for
Testing Materials.)
- International Electrical Congress at St. Louis, 1904. 1904, ii-280.
- International Engineering Congress. 1901, ii-196, 272; 1903, ii-478, 520; 1904,
ii-327, 366.
- International Good Roads Convention at St. Louis, 1904. 1904, i-494.
- International Railway Congress in Washington, D. C. 1904, ii-239.
- International Tramway Congress in Paris, 1900. 1900, ii-343.
- Interpolating contours. (See Drawing instruments.)
- Interstate Commerce Commission, Reports. 1900, i-43; 1901, i-28.
- Interstate Commerce law as nullified by court decisions. 1900, ii-212.
- Interstate Good Roads Association at Chicago. 1900, ii-372, 375.
- Interstate Mississippi River Improvement and Levee Association at New Or-
leans, La. 1903, ii-432, 435.
- Investment in new inventions. By C. R. Pratt, 1904, i-131.

"1900, ii—112" means "Year, 1900, second volume, page 112."

Iowa Engineering Society, Convention. 1903, i-115.

Iron:

Analyzing and grading of iron ores. By A. E. Separk, 1904, ii-194.

Brazil, Great hematite deposits in. 1903, i-219.

Cast iron:

Brazing by a new process. 1902, ii-*322, 363.

Chemistry and physics of. 1901, i-92.

Expansion by heat a danger in building construction. By A. E. Outerbridge, 1904, i-258.

Importance of adopting standard sizes of test bars for determining the strength of cast iron. By A. E. Outerbridge, 1903, ii-32.

Malleable cast iron. By H. E. Diller, 1902, ii-499.

Notes and observations. By J. E. Johnson, Jr., 1904, ii-173.

Physics of cast iron. By Richard Moldenke, 1904, i-245.

Chemical specifications for pig iron. By B. F. Fackenthal, Jr., 1904, ii-105.

China, Report upon iron deposits in. 1900, i-45.

Concentration of ore. Elmore process, by use of mineral oil. British Columbia. 1902, ii-281.

Electrolytic production of pure iron. 1904, i-350.

First discovery and use of iron ore in North America. 1901, i-426.

Malleable cast iron. By Richard Moldenke, 1903, i-531.

Melted in five seconds. Use of powder of German invention. 1900, i-254.

Norway. Iron ore deposits of Dunderland. By H. L. Geissel, 1900, i-276.

Ore handling, Modern methods, from Minnesota mines to Pittsburg furnaces. By C. H. Wright, 1904, i-*433, 452, 470.

Ore handling record at Lake Superior mines. 1904, ii-196.

Protection. (See Iron and steel, Protection.)

Puddled iron and mechanical means for its production. By J. M. Roe, 1903, i-*415.

Smelting. (See Electric smelting.)

Smelting house in West Africa. By C. V. Bellamy. 1904, ii-*391, 403.

Specifications for cast iron and finished castings. 1904, i-584.

Specifications for pig iron and castings. Sampling clause. Allowances and penalties clause. 1904, i-559.

Specifications for pig iron and iron castings, Phil. & Read. Ry. By Robert Job, 1904, i-253.

Strength of iron. Effect of melting steel with iron in the cupola. Tests. By H. E. Diller, 1902, i-495.

Strength of white-iron castings as influenced by heat-treatment. By A. E. Outerbridge, Jr., 1903, i-458.

Sweden, Great magnetite deposits in. 1903, i-179.

Testing iron. Standardizing the testing of cast iron. Tests made by Pittsburg Testing Laboratory. 1900, i-400.

Titanium, Influence of, on the properties of cast iron and steel. By A. J. Rossi, 1901, i-386.

(See also Iron and steel; Steel.)

Iron and steel:

Coatings:

Asphalt paint and asphaltic concrete on ballasted bridge floors. Practice of various railways. 1903, ii-*437.

Monier pipes as a covering for piles in Australia. By E. M. DeBurgh, 1901, i-100, *103, 470.

Painting and maintaining steel cars. By J. D. Wright, W. O. Quest, 1903, ii-315.

Protection of ferric structures from corrosion. By M. P. Wood, 1901, ii-213.

Report by American Society for Testing Materials. 1903, ii-30.

Tests for coatings reported on, at American Society for Testing Materials. 1904, i-583.

(See also Iron and steel, Protection; Paint; Painting; Pipe coverings.)

* denotes an illustrated article. † denotes an inset sheet.

Iron and steel: (Continued.)

Corrosion:

Influence of copper. Tests by F. H. Williams of Wheeling, W. Va. 1900, ii-365.

When embedded in concrete and placed below water level. 1900, i-240.

Electrometallurgy of iron and steel, Developments in. By M. Ruthenberg, 1902, ii-230; 1903, ii-265; 1904, i-350.

Prices:

Carnegie's prophecy concerning the course of steel prices. 1903, ii-222.

Contrast between prices to home and foreign consumers. 1901, ii-8.

Diagram showing fluctuations in prices, 1895-1900. 1901, i-71.

Pool prices for iron and steel products. 1900, ii-332.

Production:

1879-1899. Pig iron production. 1900, i-85.

Review of the Pittsburg iron market during 1899. 1900, i-60.

1897-1900. Prices and prospects. 1900, ii-197.

1900 production. 1901, i-1, 89.

1901:

Iron ore production in the United States in 1901. 1902, ii-1.

Swank's statistics for 1901. 1902, ii-89.

World's production. 1902, ii-47.

1902:

Bird's eye view of conditions in 1902. 1902, i-253.

Overproduction of iron and steel. Prospect of lower prices. 1902, ii-400.

Pig iron production in the United States for first half of 1902. 1902, ii-89.

Prospects. Lack of coke. Shortage of transportation facilities. 1902, ii-190.

Production three decades ago and to-day. By Andrew Carnegie, 1903, ii-227.

Protection of:

Cement concrete. Tests to determine the protection afforded to steel by Portland cement concrete at Boston Experiment Station. By C. L. Norton, 1902, ii-*333; 1904, i-29, 36.

Chemistry of the protection of steel against rust and fire by concrete. By S. B. Newberry, 1902, i-335.

Protection afforded by concrete. Experiments at Hempstead Harbor, L. I. Blocks exposed to sea water. By H. C. Turner, 1904, ii-*153.

Protection from locomotive gases. Paint. Mixing and applying paint. Experience on Columbus, Ohio, viaduct. By G. W. Lilly, 1902, i-322, 332, 458.

(See also Iron and steel, Coatings; Paint; Painting; Pipe Coverings.)

Specifications:

Circular asking for information issued by American Railway Engineering and Maintenance of Way Association. 1901, ii-97.

Desirability of using a single grade of steel for bridges of ordinary span, discussed by A. P. Boller, Theodore Cooper, J. E. Greiner, C. C. Schneider, J. P. Snow, T. L. Condon and A. J. Himes, 1902, i-417, 515; 1902, ii-16; By A. J. Himes, 1902, ii-329.

Discussion at American Society for Testing Materials. 1900, ii-303; 1903, ii-31.

Foundry supplies of J. I. Case Threshing Machine Co., Specifications for. 1902, ii-184.

Roller steel for railway bridges. Report at Railway Engineering and Maintenance of Way Association. 1902, i-282.

Specifications for material and workmanship for steel structures. American Railway Engineering and Maintenance of Way Association. 1903, i-274, 283.

Standard American specifications. 1900, i-322.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Iron and steel:

Specifications: (Continued.)

Standard specifications for bridges and ships, forgings and rails, by the American Society for Testing Material. 1901, ii-*11, 12, 56; 1902, i-355.

Table showing grades of steel used for bridges and buildings in some of the countries which have adopted standard specifications. 1902, i-516.

Table showing tensile strength and elongation of steel used on notable bridges. 1902, i-516.

(See also Bridge specifications.)

Tests:

Discussion of steel testing by W. R. Webster at International Engineering Congress. 1904, ii-331.

Impact tests in tension. Hatt machine at Purdue University. Weight falls vertically, velocity measured before and after striking. Results of tests on mild steel. By W. K. Hatt, W. P. Turner, D. B. Luten, 1901, i-*3, 9, 82, 103, 266.

Impact tests in tension of rolled steel. Direct measurements of the comparative "ultimate resilience per cubic inch" of various materials. Tests at St. Louis water-works and at Washington University. By S. B. Russell, 1901, i-9, *14.

Review of experimental data on impact tests of material in tension. By W. K. Hatt and Edgar Marburg, 1900, i-74.

Tension tests of punched plates. 1903, ii-89.

Iron and steel works:

Antwerp Iron & Steel Works, Belgium. Rolling mills driven by electric motors. 1902, ii-314, *321.

Appliances in German steel works. By R. M. Daelen, 1902, ii-240.

Bay State Iron Works, South Boston. Early experiments in the manufacture of open-hearth steel. By S. T. Wellman, 1901, ii-449.

Bethlehem Steel Co.:

Bonus system of rewarding labor. 1901, ii-460.

Taylor-White tool-steel process. 1900, ii-91.

Cooper, Hewitt & Co., Trenton, N. J. Early experiments in the manufacture of open-hearth steel. By S. T. Wellman, 1901, ii-448.

Dominion Iron & Steel Co.:

Description of plant. Annual report. 1901, ii-†59, 169.

Manufacture of iron and steel. 1900, ii-181, 186, 200.

Japan, Large new steel plant in. 1901, ii-97.

Jessop Steel Co., Washington, Pa. New plant. By H. G. Manning, 1903, i-*201.

Monterey Iron & Steel Co., Monterey, Mexico. 1901, ii-*464.

Nashua Iron Co., Nashua, N. H. Early manufacture of open-hearth steel. 1901, ii-449.

North Carolina works of 1777. Notes from an old report. 1902, i-348.

Nova Scotia Steel Co. 1900, ii-188.

Otis Iron & Steel Co., Cleveland, Ohio. First plant built for the exclusive manufacture of open-hearth steel. By S. T. Wellman, 1901, ii-449.

Pencoyd Steel Works. Talbot open-hearth continuous steel process. By Benjamin Talbot, 1900, ii-31.

Review of the "Directory of the Iron and Steel Works of the United States." 1902, i-253.

Rolling mill practice, Comparison between American and British. By William Garrett, 1901, i-330, 336.

Iron mines at Belle Isle, Canada. Iron ore for Dominion Iron & Steel Co. 1900, ii-187.

Iron ring, Computing strength of. By C. E. Greene, 1901, i-12, 82.

* denotes an illustrated article. † denotes an inset sheet.

Irrigation:

Arizona, Gila Indian Reservation. Exploration for bedrock at Gila River dam sites with diamond core drills. By J. B. Lippincott, 1900, i-*334.

Arkansas Valley Sugar Beet & Irrigated Land Co., Colorado. Canals, dams and headgates. By W. P. Hardesty, 1902, ii-†405.

California. Water storage and irrigation works of Southern California. San Diego Land & Town Co. Southern California Mountain Water Co. By Robert Fletcher, 1901, ii-124.

Canals:

Arkansas Valley Sugar Beet & Irrigated Land Co., Colorado. By W. P. Hardesty, 1902, ii-†405.

Calculating volume. Prismoidal correction formula. By F. T. Lewis, F. E. Foss, 1901, i-30, 31.

California and Wyoming canal projects. 1903, i-421.

Cement-lined canals of North Riverside & Jarupa Canal Co., California. Method of cementing. By E. Duryee, 1901, i-*140.

Cost and sources of power for pumping irrigating water. By H. A. Storrs, 1904, ii-548.

Devices for applying water to crops. 1903, i-513.

Discussions at annual meeting of National Irrigation Association, Chicago, 1900. 1900, ii-378.

Drainage of irrigated lands in the West. Difficulties. By Ernest McCullough, 1903, ii-158.

Government work:

Conference at Cheyenne. Text of bill drafted. Policy of bill attacked by G. H. Maxwell, 1901, i-468; By Fred Bond, G. H. Maxwell, J. L. Campbell, J. B. Lippincott, 1901, ii-88, 91, 122, 177.

Government vs. private control of irrigation works in the arid regions. Discussion by Elwood Mead, 1902, i-519.

President Roosevelt on national irrigation work. 1903, ii-256.

State canals under the Carey Act. Wyoming first state to build canal. By Elwood Mead, 1901, ii-394, 474.

Stations for irrigation investigations and names of observers. 1901, i-159.

Hawaiian sugar plantation. By C. H. Kluegel, 1904, i-269.

India:

Kistna delta. Construction of a dam for the reclamation and irrigation of the delta and surrounding country. 1901, ii-†355.

Periyar dam and irrigation works. 1901, ii-*298.

Investigations in New Jersey, Wisconsin, Missouri and the South. From report of Elwood Mead, 1903, i-523.

Louisiana. Canal to be constructed in the rice belt. 1902, i-35.

Montana. Dearborn state irrigation canal. 1901, ii-394.

Nile Valley, Egypt, Irrigation in, and its future. By W. Willcocks, 1901, ii-219.

Ohio, Little Miami Valley. Recommended by Ohio Water Delivery & Irrigation Society. 1902, ii-240.

Oregon, Needed irrigation in Eastern. By A. J. Frye, 1901, ii-390.

Preparing land for irrigation, Methods of, in different sections of the United States. 1904, i-564.

Report on United States Irrigation investigations for 1900. 1902, ii-*208.

Rio Grande valley of New Mexico and Texas. Test of pumping plants and wells. By C. S. Slichter, 1904, ii-580.

South Africa. Pan-formation in relation to irrigation problems. 1902, i-177.

Stream flow and storage in relation to irrigation. By Elwood Mead, 1903, i-556.

Universal irrigation. By C. H. Scott, 1902, ii-192.

Use of water in irrigation. Report of investigations made in 1899 under supervision of Elwood Mead. 1901, i-158.

Utah. (See Reservoirs, Utah Lake.)

"1900, ii-112" means "Year, 1900, second volume, page 112."

Irrigation: (Continued.)

Winter irrigation of deciduous orchards in Southern Arizona. Experiments. 1901, ii-103.

(See also Land reclamation.)

Irrigation engineers. (See Engineers, Examination.)

Isles. (See Refuge isles.)

J.

Jacks:**Hydraulic:**

Shop jacks, wrecking jacks and jack for crank pins. By G. L. Gillon, 1901, i-*94.

Valve mechanism construction, Kiel concrete dry docks. 1903, ii-*497.

Pipe forcing jack, to obviate trenching. Duff Mfg. Co. 1903, i-*257.

Sand jack at Battle Monument, West Point. Use of jack in placing shaft.

By E. F. Miner, 1904, i-62.

Sand jacks used in moving and lowering drawbridge, Newark, N. J. By Lincoln Bush, 1903, ii-*596.

Track jacks:

Report at Roadmasters' Association. 1902, ii-221.

Union jack. 1900, ii-*63.

Japan, Notes of an engineer in. By W. E. Crane, 1904, ii-591.

Jessop Steel Co., Washington, Pa. New plant. By H. G. Manning, 1903, i-*201.

Jets, Form and velocity of. Experiments with Pitot tubes. By J. E. Boyd and Horace Judd, 1904, i-*318.

Jetties at Galveston, Texas, Report on, as affected by the storm of Sept. 8, 1900. 1901, i-113.

(See also Rivers, Mississippi.)

Jewell, I. H. Concerning the I. H. Jewell Filter Co. By G. E. Burroughs, I. H. Jewell, 1901, i-190, 210.

John Fritz medal, Rules of award for. 1902, ii-128, *383; 1903, ii-96.

Johnson, John Butler, Biographical sketch of. 1902, ii-16, 31.

Johnson's "Framed Structure." Errors in. By Theodore Cooper, 1903, i-103.

Joints:

Ball joint for packing Corliss valve stems. 1904, ii-*150.

Double-cone washer for timber joints. By L. S. Austin, 1904, ii-*348.

Single-leg connections for angles. By R. E. Kimball, 1903, i-454.

(See also Bridge joints; Pipe joints; Rail joints; Riveted joints.)

Joist hangers, Inefficiency of the stirrup type. Merits and demerits of various types. By F. E. Kidder, E. Haupt, 1903, i-*58, 128; 1903, ii-172.

Jones, Samuel M., Mayor of Toledo, Ohio, Death of. 1904, ii-71.

Journal bearings. Hot boxes and ear journal bearings. Use of raised strips on bearings. By S. P. Bush, 1901, i-*138.

Journal box, bearing and wedge for 100,000-lb. cars, Proposed. 1900, i-*429.

Journal of the Association of Engineering Societies, Subscriptions to. By J. C. Trautwine, Jr., 1904, i-203.

Journalism, Moral Standards in technical. Recollections of Ericsson. By E. P. Watson, 1901, ii-24.

Joveite:

Safe and economical substitute for dynamite. By R. T. Dana, G. W. Hughes, 1903, i-73, 79, 80, 128, 197.

Use of, in yards of N. Y. C. & H. R. R. 1904, i-81.

K.

Kansas-Colorado water rights controversy. 1904, ii-503.

Kansas eight-hour law decision. 1904, i-Cons. News Sup. Jan. 21.

Kansas City, Mo. Notes by an engineer. 1901, ii-475.

Kilns. (See Cement kilns.)

Kingsley, M. W., Superintendent of Cleveland water-works, Dismissal of. 1901, ii-327.

* denotes an illustrated article. † denotes an inset sheet.

Knuckles. Specifications for purchasing and testing separate knuckles for M. C. B. Couplers. 1904, i-610.

Krupp, Frederick. Industries operated by the Krupp firm. 1900, ii-173.
L.

Labor question:

Arbitration of differences by George A. Fuller Co. 1903, ii-25.

Baldwin locomotive works. Features of the labor system and management of works. By J. W. Converse, 1903, i-31.

Bonus system of rewarding labor by the Bethlehem Steel Co. By H. L. Gantt, 1901, ii-460.

Coal miners, Average wages of. Demands of miners in the coal strike, 1902, ii-401.

Convict labor and road building in the Southern States. By J. A. Holmes, 1902, ii-432.

Cost of tunneling and mining by the "hole contract system." Experience at mines of Rossland, B. C. 1902, ii-483.

Day work, Cost of, on Spot Pond Reservoir. By C. M. Saville, 1901, ii-445.

Day's labor and contract work. Experience with masons. By F. A. Mahan, 1902, ii-50.

Discipline, Efficient. By J. I. Riegel, 1903, i-36.

Eight-hour days in the foundry industry. By Richard Moldenke, 1903, i-264.

Eight-hour law declared void in New York State. 1903, i-420; 1904, ii-508, 523.

Eight-hour law in Kansas. 1904, i-Cons. News Sup. Jan. 21.

Employers' liability law in Great Britain. Results of experience. 1904, ii-254.

Engineering employment bureaus, Work of. 1903, i-430.

English and American labor compared, in bridge manufacturing. 1902, ii-112.

French railways, Work and wages on. 1902, ii-359.

Gift propositions for paying workmen. By E. P. Goodrich, Frank Richards, 1903, i-168, 174, 256.

Industrial legislation in Australia. 1904, ii-362.

Kansas eight-hour law decision. 1904, i-Cons. News Sup. Jan. 21.

Massachusetts Pipe Line Gas Co., Wages paid by. By W. W. Cummings, 1902, ii-252.

Merit system of discipline. By W. A. Satterlee, 1902, ii-324.

Mutual benefit association and pension system of Metropolitan Street Railway Co., of New York. 1902, ii-324.

Night shifts, Working of, not economical at Toledo plant of American Bridge Co. 1903, ii-442.

Paving with brick and stone blocks, Cost of. By H. P. Gillette, 1902, ii-69.

Premium system of remunerating labor. By William Wier and J. R. Richmond, 1901, ii-207.

Railway employees wages increased 10 per cent. Extent to which railway earnings go to pay wages. 1902, ii-448.

Social engineering. Betterment of industrial conditions. 1900, ii-444.

Time element in loading and unloading carts and in carting. Experience of George H. Parker on Keney Park, Hartford, Conn. 1901, i-54.

Tunneling work. Composition of force employed and wages paid, Canadian Pacific Ry. on Crow's Nest Pass Line. By C. R. Coutlee 1903, i-291.

Viewpoints of the outdoor man and the indoor man. Meaning of statistics. Concerning earnings and wages. 1902, ii-502.

Wage systems and shop management. 1903, ii-515.

Wages, Rational basis for. By Harrington Emerson, 1904, i-536.

What shall fix fair wages? By C. W. Comstock, 1901, ii-72, 161.

Laboratories:

Bacteriological, North Carolina, Proposed. 1900, ii-92.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Laboratories: (Continued.)

- Case, J. I., Threshing Machine Co., Racine, Wis. Physical and chemical laboratory. 1902, ii-*35.
- Electrical laboratory in New York State. Report of Bond, Steinmetz and Buck on the establishment of a state laboratory. 1903, i-189.
- Gayley laboratory at Lafayette College, Easton, Pa. Dedication. 1902, i-*291.
- Mt. Prospect, Brooklyn water-works. By G. C. Whipple, 1900, i-376, *381.
- Municipal testing laboratory of Indianapolis. By Walter Buehler, 1904, i-69.
- Ore dressing laboratory at Columbia University, New York. 1903, i-155.
- Road material testing laboratory, United States Department of Agriculture. 1900, ii-321.
- South Carolina Agricultural and Mechanical College laboratory. 1903, ii-35.
- Ladder for chimneys, stand-pipes or other high structures. 1901, i-*430.
- Ladle car for handling molten slag, 16 tons capacity. M. H. Treadwell & Co. 1902, i-*444.
- Ladle truck at Sturtevant foundry, Hyde Park. 1903, ii-*417.
- Lake Erie, Wind velocity and fluctuations of water level of. Report by Alfred J. Henry. 1902, ii-72.
- Lake Superior Mining Institute, Annual meeting at Ironwood, Mich. 1904, ii-176.

Lakes:

- Removing floating bog from, Newark, N. J. By T. H. McCann, 1904, i-544, 589.
- Tapping a lake in France 60 feet below the water surface, for water supply. 1901, i-117.
- Wind velocity and fluctuations of water level on Lake Erie. Report by Alfred J. Henry. 1902, ii-72.
- (See also Great Lakes.)

Lamp post for arc lamps, Cincinnati. 1903, ii-*168.

Lamps. (See Acetylene, Mining lamp; Electric lamps.)

Land reclamation:

- Chicago Supreme Court decision in regard to made land. Chicago vs. Illinois Central R. R. 1900, i-185.
- Forestry and land reclamation in Southern France. 1904, i-400.
- Holland. Proposed reclamation of the Zuyder Zee. 1902, i-40.
- Kistna delta, India. Construction of dam to control waters of the Kistna River. 1901, ii-†355.
- League Island Park, Philadelphia. American Dredging Co.'s plans. 1902, i-41.

Made land:

- Chicago vs. Ill. Cent. R. R. 1900, i-185.
- Wisconsin law. 1901, i-55.
- New Jersey and Staten Island marshes. By H. C. Weeks, 1904, i-333.
- Seattle, Wash. Filling in tide-water flats. 1901, i-*440.
- St. Francis Basin, Arkansas and Missouri. Protection of land by levees. Compared with the work done in Holland and in Egypt. By H. N. Pharr, 1902, i-24, 28.
- United States reclamation service in the arid West. By E. H. Newell. 1903, ii-485.
- Wisconsin law on made land. 1901, i-55.
- (See also Drainage; Irrigation.)

Landscape architecture or gardening, Books on. 1903, i-Eng. Lit. Sup. Mar. 19.

Landslides:

- Frank, Alberta. Investigation by the Geological Survey of Canada. 1903, i-*492.
- Irrigation as a cause of landslides. Slides on the Canadian Pacific Ry. By H. J. Cambie, 1903, i-38.

* denotes an illustrated article. † denotes an inset sheet.

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Portneuf Co., Quebec. Remarkable landslide on May 7, 1898, on the Riviere Blanche. Examined by Dr. Geo. M. Dawson, Director, Geological Survey of Canada. 1900, i-175.

Lathes:

Granite columns turned in lathe of Bodwell Granite Co., Rockland, Me. 1903, ii-*491.

Heavy-service lathe, with direct-connected motor and multiple-voltage speed control. Bullard Machine Tool Co. 1903, ii-*106.

100-in. driving wheel lathe in shops of Chic., Mil. & St. Paul Ry. 1903, ii-153.

Rapid reduction in the lathe as compared with forgings. By F. B. Kleinhans, 1903, ii-*407.

Requirements for light lathes and screw machines. By John Ashford, 1901, i-*179.

Latitude of New York, Variations in. Observations at Columbia University. 1900, i-297.

Latitude, longitude and solar time in reconnaissance surveys, Methods of determining. By W. S. Post, 1900, i-138, 145.

Launch, High speed gasoline, and power of various types. 1904, ii-482.

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Launching a cruiser and a battleship. By James Dickie, 1900, ii-†350.

Practice in launching warships in the United States. By R. H. M. Robinson, E. P. Lesley, 1904, ii-*536.

Side-launchings of the "Galveston" and the dredge "Benyuard". By W. G. Groesbeck, 1903, ii-*498.

Le Chatelier apparatus for determining the specific gravity of cement. 1903, i-*109.

Lead poisoning:

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Lowell, Mass. Danger from the Cook and the Hydraulic wells. 1900, i-265.

Milton, Mass. Report by Massachusetts Board of Health. 1902, i-125.

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League of American Municipalities, Conventions. 1900, ii-424, 428; 1901, ii-144; 1902, ii-173; 1903, ii-347.

Ledoux, Albert R., Biographical sketch of. 1904, i-†90.

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Electric lighting. Easement in streets. 1900, i-70.

Electric wiring. Liability of company for injury by wire. 1900, i-343.

Electrolysis in Indianapolis, Ind. Court decision as to responsibility for damage by electrolysis to gas mains. 1901, i-12.

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Kansas-Colorado water rights controversy. 1904, ii-503.

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- Northern Securities case. Why not have a National Corporation Law for companies engaged in interstate commerce? 1903, i-346, 388.
- Railways, Selections of route for. 1900, i-70.
- Sewers, City's liability for sanitary conditions in. 1900, i-70.
- Street railways, Removal of tracks of. 1900, i-175.
- Streets, Use of for electric railways. Illinois law. 1900, i-175.
- Surveys, Discrepancy between plat and minutes of. 1900, i-131.
- Trade name, Property right in. 1901, ii-330.
- United Engineering & Contracting Co. Piling in East River damaged by tugs of N. Y., N. H. & H. R. R. 1903, i-205, 225.
- Water pollution in Waterbury, Conn. 1900, i-230.
- Water-works. Powers of water commissioners. 1900, i-343.

Letter-press, Home-made, for camp use. By S. O. Taylor, 1904, ii-*91.

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- Graduation of. 1901, ii-122.
- Level rod for cross-sectioning earthwork, Gillette. By H. P. Gillette, 1900, ii-*182.
- Oswego-Mohawk canal survey. Steel turning pin. By D. J. Howell, 1900, i-*405.

Leveling:

- Instructions for. From report of New York State Engineer and Surveyor. Standards of accuracy. By C. E. Babb, William Harkness, 1902, i-340, 353, 437.
- Tallest leveling on record. Experience in Alaska. By A. McL. Hawks, 1903, i-104.

Levels:

- Book of bench marks at Hartford, Conn. 1902, ii-373.
- Coast & Geodetic Survey precise level; a possible successor of the Wye level. Cases of rapid leveling. By J. F. Hayford, 1903, ii-*2.
- New levels for precise leveling designed by T. C. Mendenhall. 1903, i-*375.
- Library for a young civil engineer. 1903, i-Eng. Lit. Sup. Mar. 19, April 16.
- Lift works. (See Canal locks.)

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- Diamond Shoal, New plan for. 1904, i-327, 378.
- Mile Rock, San Francisco Bay, Plans for. 1904, i-*561.
- Steel casing for brick lighthouse tower on Cana Island, Wisconsin (Lake Michigan). Steel shell with space between it and tower filled with concrete. 1902, ii-*78.

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- Lightning arresters. Function of shunt and series resistance. By P. H. Thomas, 1902, ii-5, 6.
- Lightning protection of transmission lines. (See Electric power, Line construction.)

Lignite as a fuel for a locomotive, Bismarck, Washburn & Gt. Falls Ry., North Dakota. 1902, i-317.

Lima Locomotive & Machine Co. New works at Lima, Ohio. 1902, ii-98.

Lime:

- Manufacture and properties of hydrate of lime. Strength tests of mixtures of hydrated lime and Portland cement. By S. Y. Brigham, Charles Warner, W. H. Malley, 1903, ii-177, 320, 544; 1904, i-543.
- Standards for hydrated lime adopted by manufacturers. By Charles Warner, 1904, ii-220.

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Limestone, Becraft, Analysis of. 1903, ii-70.

Line construction of electric plants. (See Electric power, Line construction.)

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Linde liquid air machine at the University of Michigan. By A. L. Davenport, 1900, i-*154, 224.

Oxygen gas. Production of cheap gas from liquid air. Fallacy of liquid air motors. 1900, i-392; By Charles Prelini, 1900, ii-9.

Practical applications. By Carl Linde, 1900, i-224, *230.

Tripler Liquid Air Co. Tripler prospectus compared with statements by Prof. Linde. Finances. 1900, i-174, 224; 1901, ii-156.

Liquid air engine efficiency. 1902, ii-348.

Liquid Air Power & Automobile Co., Receiver appointed for. 1901, ii-8.

Lithographic stone deposits of eastern Kentucky. 1902; ii-63.

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Loading wheel scrapers by means of hoisting engines. Water-works in Victoria, Australia. By G. H. Dunlop, 1904, i-588, 594.

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Ash pan, D., L. & W. R. R. Wide firebox locomotive. 1901, ii-*62.

Atlantic type passenger locomotive, Wabash Ry. 1904, i-*249.

Changing water in boilers, New system of. Pittsburg & Lake Erie R. R. at McKees Rocks, Pa. Heat of water blown off used for heating water for refilling. By A. R. Raymer, 1904, ii-*390.

"Chautauqua" type of locomotive, C., R. I. & P. Ry. 1901, ii-*18.

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Atch., Topeka & Santa Fe Ry. Consolidation freight locomotive burning oil. 1902, i-*328.

Vanderbilt design on the N. Y. C. & H. R. R., the Union Pacific R. R. and the Balt. & Ohio R. R. Good results from economy tests. 1901, i-47, 297.

Decapod compound locomotive, Atch., Topeka & Santa Fe Ry. 1902, i-*331.

Design of front-ends. By W. F. M. Goss, 1903, ii-*457.

Draft in ash pans. By S. Shepard, 1904, i-59.

Feed-water heating. Proposed arrangement of heater, use of exhaust steam. 1901, i-*460, 469.

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Firebox with brick arch and air tubes on Cincinnati Southern Ry. 1902, i-*146.

Foaming waters and scaling waters. Benefits due to scale in boilers. By M. E. Wells, William Kent, 1904, ii-60, 71, 198.

Four-cylinder balanced compound locomotives, Atch., Topeka & Santa Fe Ry. 1904, i-*297, 304.

Grates for bituminous coal. By J. A. Carney, 1904, ii-*13.

Leaky locomotive flues, One cause of. Tests on the Pitts., Cin., Chic. & St. Louis Ry. By S. W. Miller, 1902, ii-215.

Marine boiler on the Atch., Topeka & Santa Fe Ry. Experiments. 1900, i-121.

Repairs of fireboxes. "Raised" patches advised by W. H. Graves, of Burlington & Missouri River R. R. 1901, i-17.

Report at American Railway Master Mechanics' Association. Table giving dimensions of American and foreign locomotives. 1903, ii-21.

"Serve" tubes for flues a failure in American locomotives. 1902, ii-413.

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Perfection fuel economizer and smoke consumer. Results of tests on N. Y. C. & H. R. R. R. 1902, ii-*152.

Reports from the various railways entering Chicago in response to circular letter of Western Railway Club. 1900, i-278.

Walker apparatus fitted to firebox. 1903, i-*461.

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Tubes, Handling, cleaning and setting. 1901, i-*472.

Water arch for locomotive fireboxes. Montana Central Ry. Experience. 1903, i-*263.

Water purification:

Chic. & Northwestern Ry. Results from the use of hard and soft water. Analysis of water used. Boiler compounds. Purifying apparatus. By G. M. Davidson, 1903, i-*296.

Notes on treatment of water. By G. R. Henderson, 1903, ii-279.

Water-tube firebox invented by J. Brotan. 1903, ii-*284.

Wide firebox, for burning anthracite culm, D., L. & W. R. R. Details of ash pan. 1901, ii-*62.

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Locomotive brake shoes, Tests of, Chic., Rock Island & Pacific Ry. By W. H. Stocks, 1902, i-159.

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Electric headlight throwing both vertical and horizontal beams. Chic., Mil. & St. Paul Ry. 1902, i-158.

Notes on locomotive headlights by William McIntosh. 1903, ii-22.

Rushmore lens mirror searchlight, Acetylene. 1902, ii-*67.

Locomotive pilots. Benefits of. The pilot as a safety device illustrated by accidents on English railways. 1900, i-208.

Locomotive shops:

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Balt. & Ohio Southwestern Ry., Washington, Ind. Drop pit for removing wheels. Recording defective staybolts. Blowing off steam in roundhouse. 1901, ii-*80.

* denotes an illustrated article. † denotes an inset sheet.

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Chic., Mil. & St. P. Ry., West Milwaukee, Wis. Extensions proposed. 1903, ii-35.

East Moline, Ill., Chic., R. I. and Pacific Ry. 1904, i-*139.

Lehigh Valley R. R., Sayre, Pa. 1903, i-465, *570.

Phil. & Read. R. R., Reading, Pa. New repair shops. 1900, i-†339, 377.

Typical shop to serve a road or division equipped with 300 locomotives. By L. R. Pomeroy, 1902, ii-*23.

Locomotive testing plants:

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Locomotive valves:

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"Compensating" throttle valve, Chambers invention. 1901, i-*305, *322.

European locomotives at Paris Exposition. 1900, ii-5.

Piston valves. Discussion at Master Car Builders' Association. 1900, i-432.

Piston valves on simple engines, Chic., Bur. & Quincy R. R. S. M. Vauclain opposes such use. 1901, i-309.

Piston valves and the value of by-pass valves. 1904, ii-13.

Piston and slide valves tested on Norfolk & Western R. R. and on Lake Shore & Mich. Southern Ry. 1904, i-13.

Report on piston valves by American Railway Master Mechanics' Association. 1903, ii-22.

Stephenson link motion. Investigation by Jesse I. Brewer of Swarthmore College. 1900, ii-312.

Locomotive wheels:

Flat spots, Cause of. British theory. 1900, ii-280.

Gages for wear of driving wheels. Chic., Bur. & Quincy R. R. and Chic., Mil. & St. Paul Ry. 1900, i-*216.

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Baldwin Locomotive Works. Labor system and management of works. By J. W. Converse, 1903, i-31.

Consolidation of Brooks, Schenectady, Pittsburg, Richmond, Cooke, Rhode Island and Manchester Works as the American Locomotive Co. 1901, i-376.

Lima Locomotive & Machine Co. New works at Lima, Ohio. 1902, ii-98.

Locomotive & Machine Co., Montreal, Canada. By M. J. Butler, 1904, i-*602.

Russia. Hartmann Machine Co., at Lugansk. 1900, ii-37.

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Chic. & Alton Ry. Passenger locomotive of the Pacific type. 1903, i-*474.

Chic., Bur. & Quincy R. R. Development of Columbia type. 1900, i-217.

C., C., C. & St. Louis R. R. Heavy express locomotive for passenger service. 1902, ii-*330.

Cincinnati Southern Ry. Notes on standard locomotives. 1902, i-*145.

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De Glehn locomotive, Paris & Orleans Ry. 1904, i-*310, *499.

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N. Y. C. & H. R. R. Ry. Cole locomotive. Record at St. Louis on testing plant of Penn. R. R. 1904, i-491, *581; 1904, ii-508.

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Four-cylinder duplex, Mallet system, Balt. & Ohio Ry. 1904, i-*605.

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Atch., Topeka & Santa Fe Ry. Engines with corrugated furnaces. Use of oil fuel. 1902, i-*328.

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Newburg, N. Y. Electric Ry. Box car for package freight hauling loaded trailer. By Burcham Harding, 1900, i-*60.

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Lignite fuel. Locomotive specially designed by Baldwin Works for the Bismarck, Washburn & Gt. Falls Ry., North Dakota. 1902, i-317.

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Hauling capacity. Equated tonnage rates for freight locomotives. Methods of test and calculation. By M. H. Wickhorst, 1903, i-354.

Hauling capacity of 18-in. x 24-in. locomotive, in net tons, including weight of cars. By K. W. Blackwell, 1904, i-143.

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Painting locomotives. Report at American Railway Mechanics' Association. 1904 ii-13.

Petroleum locomotive, English design. 1904, ii-*435.

Power of locomotives, Some factors affecting. By W. F. M. Goss, 1902, i-201.

Oil burning systems. (See above, Fuel.)

"Prairie type" on C. & B. & Q. R. R. and L. S. & M. S. Ry. 1901, i-263, 309, *399.

Purdue University engine. Series of tests and their results. By W. F. M. Goss, 1900, ii-414.

Rating of locomotives. (See Train loads.)

Riekie engine, a thermodynamic curiosity. 1900, ii-280.

St. Louis Exhibition of locomotives. 1904, ii-*297.

* denotes an illustrated article. † denotes an inset sheet.

Locomotives: (Continued.)

Schneider high-speed locomotive for international express service. Novel design. Cab in front of boiler. Paris Exposition. Results of tests. 1900, ii-†258, 273.

Sixteen-wheel tank locomotive, South African railways. 1901, i-339.

Size of locomotives. Has the increase in weight of freight trains and locomotives reached its limit? Effect upon freight rates. 1901, ii-408.

Smoke prevention. (See Locomotive boilers and fireboxes, Smoke prevention.)

Smokestacks, Dimensions of taper. Table. By W. F. M. Goss, 1903, ii-†458.

Spark arrester, German invention. 1904, i-223.

Statistics of construction, 1898-1902. 1902, ii-540.

Steam storage, Franco system. Used in Dutch East Indies since 1883. 1901, i-358.

Stokers:

Day-Kincaid. 1904, ii-13.

Kincaid. By F. H. Colvin, 1902, i-†456.

Superheaters:

Pielock, on German four-cylinder balanced compound locomotive. Prussian State railways. 1904, ii-†469.

Prussian State railways. Built by A. Borsig. 1900, ii-†274.

Switch engines. Ton-mile statistics. 1904, ii-11.

Tandem compound:

Atch., Topeka & Santa Fe Ry. Consolidation freight. Ten-wheel passenger. Decapod four-cylinder. 1900, i-33; 1902, i-†329.

Northern Pacific Ry. Four-cylinder freight locomotives for heavy service. 1902, i-†330.

Tank:

Consolidation suburban tank engine, Great Northern Ry. 1903, ii-192. Indian State Railways. Mushkaf-Bolan Division of Northwestern Ry. 1901, i-†378.

N. Y. C. & H. R. R. R. Heavy locomotives for suburban service. 1901, i-358.

Sixteen-wheel locomotive, South African railways. 1901, i-339.

Ten-coupled tank locomotive for suburban service. Great Eastern Ry., 1903, i-116.

Three-cylinder suburban, Great Eastern Ry., 1902, i-456.

Ten-wheel:

"Back ended." Southern Italian Railways. Paris Exposition. Cab in front. 1900, ii-113.

Cape Government Railways, South Africa. 1901, i-†298.

Del., Lack. & West R. R. Compared with ten-wheel locomotive of L. S. & M. S. Ry. 1900, i-†298.

Freight locomotive of unusual size, Gt. Western Ry., England. Ugly and disproportional. 1901, i-297.

Northeastern Ry., England. 1900, i-†202.

Scotland, Highland Ry. 1900, ii-217.

Southern Pacific Ry. 1901, i-†340.

Tests of Brooks passenger locomotives, Hocking Valley Ry. By E. A. Hitchcock, 1904, ii-541.

Tonnage. (See Train loads.)

Traction increasers:

Atch., Topeka & Santa Fe Ry. 1902, i-331.

Chic. & Alton Ry. 1903, i-†475.

Tractive power, Rule for finding. 1903, i-60.

Twelve-wheel, Chic. & East. Ill. Ry. Heavy freight engine. 1900, i-†131; 1900, ii-†330.

Vanderbilt design. (See Locomotive boilers and fireboxes, Corrugated.)

Water service. (See Railway water stations.)

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Water tank and coal box combined, invented by Cornelius Vanderbilt. 1901, ii-*407.

Weight:

Increase of, during ten years. 1900, i-8.

Table of weights of locomotives. Motive power and equipment in relation to maximum trains. By E. E. R. Tratman, 1902, i-337.

Welding cracked frames in place, Southern Pacific Ry. 1901, ii-33.

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Logarithmic functions of small angles, Rule for finding. By E. B. Escott, A. I. Frye, Antonio Llano, 1904, i-82, 203, 283.

Longitude girdle of the earth: determination of the difference in longitude between San Francisco and Manila. By Edwin Smith, 1904, ii-309.

Longitude of Honolulu, Determination of, 1555-1903. By J. F. Hayford, 1903, ii-414.

"Loop the Loop." (See Centrifugal railway.)

Lubrication:

Hydraulic elevator plungers. By Edward Van Winkle, 1904, i-283, *494.

Locomotive valves and cylinders. By D. R. MacBain, 1904, i-219.

Tests of lubricating oils. By Albert Kingsbury, 1902, ii-*538.

Wheels of chain conveyors. Use of absorbent packing. 1902, ii-*35.

Lubricators:

Experiments at Worcester Polytechnic Institute. Air as a lubricant. By H. S. Heichert, 1900, i-*158.

Oil cup for pressure oiling systems, Lunkenheimer. 1901, i-*164.

Steam engine lubricator. Positive oiling apparatus with sight-feed distribution. Henry Hamelle, 1900, ii-*106.

Ludlow, William, Biographical sketch of. 1901, ii-155.

M.

McAdam, John Loudon, Biographical sketch of. 1901, ii-*487.

McDonald, Hunter, Biographical sketch of. 1904, i-†93.

Machine shops. (See Shops and factories.)

Machine tools:

Comparison of American and European, at Paris Exposition. 1900, ii-105.

Coping machine, Whiting. 1904, i-*55.

Development of machine tools. By J. K. Cullen, 1902, ii-471.

Electric power driven:

Modern Steel Structural Co., Waukesha, Wis. 1902, ii-101.

Tests made upon machines. By F. R. Jones, 1900, ii-405.

Tests of electric driving equipment in the works of the Morden Frog & Crossing Co. By M. F. Moore, 1903, i-472.

Finishing tools for facing the grooves and rings of pistons. 1900, i-*184.

Improvements in the design of tools. Quotations from papers by J. K. Cullen, J. A. Carney and K. Dodge, 1904, i-449, 455.

Portable vs. stationary tools. Discussion at American Society of Mechanical Engineers. 1901, i-421.

Power required to drive tools. Shafting vs. electricity. 1900, ii-19.

Range of speed to be obtained from a pair of equal cones, Method of calculating. By F. B. Kleinbans, 1903, i-*266.

Rating of machine tools in locomotive machine shops. By J. F. De Voy, 1903, ii-587.

Requirements in up-to-date shops. Lathes and screw machines. By John Ashford, 1901, i-*179.

Requirements of machine tool operation, with special reference to the motor drive. By Charles Day, 1903, i-*43.

Shearing machine, Whiting. 1904, i-*55.

Specifications of Penn. R. R. and American Bridge Co. 1904, i-449, 455.

Speed, Increasing. High speed steel. By J. A. Carney, 1903, ii-586.

* denotes an illustrated article. † denotes an inset sheet.

Machine tools: (Continued.)

- Speed variation with electric motors. By J. J. Flather, 1903, i-6.
 Value of modern tools for railway shops. By M. K. Barnum, 1902, i-239.
 What are the new tools to be? By J. E. Sweet, 1903, ii-508.
 (See also Hydraulic tools; Pneumatic tools.)
- McKinley, William, Photograph of, and of party on the Niagara Gorge electric railway. 1901, ii-*186, 196.
- McMath, Robert Emmet, Biographical sketch of. 1901, i-†44.
- Madagascar, Railway and transportation situation in. 1904, i-*387.
- Madison Park and Pleasure Drive Association, Madison, Wis., Work of. By W. D. Taylor, 1903, ii-*511.
- Magnalium. 1901, i-419; 1901, ii-450.
- Magnetic brakes. (See Brakes.)
- Magnetic waters in Indiana. By M. O. Leighton, 1903, ii-65.
- Maintenance of way. (See Railway maintenance of way.)
- Manganese in India. 1900, ii-157.
- Manholes:
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 Concrete block manholes built by New York Telephone Co. By H. C. Baker, Jr., 1904, i-*58.
 Deep manhole construction on sewer tunnel, Brooklyn, N. Y. 1901, ii-*272; 1903, i-*8.
 Dirt pans, Medford, Mass. 1902, ii-435.
 Electric conduits:
 Cincinnati. 1903, ii-*168.
 Memphis, Tenn. By F. G. Proutt, 1904, i-*365.
- Manufacturing industries, Organization of. By Andrew Carnegie, 1903, i-436.
- Manufacturing wastes, Purification of. Work of the Massachusetts State Board of Health. 1901, ii-391.
 (See also Water pollution.)
- Marine boilers:
 Combination boiler equipment for cruisers and battleships. Report of British Admiralty committee. 1902, ii-168, *176.
 Nickel-steel tubes. Properties of tubes. Corrosion and oxidation tests. By A. L. Colby, 1903, ii-468.
 Propelling machinery of a torpedo-boat destroyer. Boilers and boiler feeding, steam-pipes, engines, balancing, air pumps, valves, shafting, propellers, etc. By W. D. S. Brown, 1901, i-28, 36.
 Uniformity in specifications. Report on and bill proposed by American Boiler Makers' Association. 1904, ii-373.
 Ward section coil boiler on light draft river tug "James Rumsey." 1903, i-*457.
- Water-tube boilers:
 American mercantile marine. Design, cost and history. By W. A. Fairburn, 1902, ii-446.
 Babcock & Wilcox boilers on the U. S. S. "Marietta." Five years practical experience. By H. C. Dinger, 1903, i 324, *328.
 Belleville boiler. Investigation by British Admiralty Committee. 1900, ii-117, 193; 1901, i-177, 244; 1902, ii-168, *176; 1903, i-185.
 Cleaning with turbine tube cleaner on "Marietta." By C. H. Dinger, 1903, i-*329, *330.
 Hohenstein boiler. Tests. Table showing comparison with straight-tube boilers of U. S. Naval Service. By John Halligan, Jr., 1903, i-324, *332.
 Report on various boilers by the British Admiralty Committee. Supplementary report by John List. 1902, ii-168, *176.
- Marine engineering during ten years. By James McKechnie, 1901, ii-†139.
- Marine engines:
 Balancing. By W. D. S. Brown, 1901, i-37.
 Coal consumption. Diagram for finding daily consumption. By H. Wilkes, 1903, i-192.
 "1900, ii-112" means "Year, 1900, second volume, page 112."

Marine engines: (Continued.)

- Comparison of typical engines, 1872, 1881, 1891 and 1901. Fuel economy, pipe joints, high pressures, stresses, etc. By James McKechnie, 1901, ii-†139.
- Crank shafts, Table for proportioning. By H. Wilkes, 1903, i-193.
- Maintenance of machinery in merchant ships. By Robert Haig, 1904, ii-470.
- Propelling machinery of a torpedo-boat destroyer. By W. D. S. Brown, 1901, i-28, 36.
- Shafting. Diameter and strength of. Comparison of shaft for engine of same power in 1890 and 1900. By James McKechnie, 1901, ii-141.
- Slide-valve relief rings. By James McKechnie, 1901, ii-*141.
- Tests of Scotch and American engines. Useful data from Scotch practice. By H. Wilkes, 1903, i-192.
- Turbine engines for scout ships of the Navy. 1903, ii-213.

Masonry:

- Brick masonry laid with lime-cement mortar. Severe test of wall. 1904, ii-*289.
- Brooklyn tower of third East River bridge. 1901, i-*173.
- Discussion at meeting of American Railway Engineering & Maintenance of Way Association. 1901, i-206.
- Disintegration, Cause of. Heat expansion theory. By H. P. Gillette, 1902, ii-340.
- Notes of experience in constructing masonry. By E. S. Gould, F. A. Mahan, 1902, ii-50, 66.
- Report at American Railway Engineering and Maintenance of Way Association, March, 1902. 1902, i-245.
- Soda, Use of, in laying masonry in winter, in France. 1901, ii-78.

Specifications:

- Ambiguity in. 1903, ii-Cons. News Sup., Oct. 1, 8.
- Wachusett dam, Boston Water Supply. Rubble stone masonry. By A. D. Flinn, 1900, ii-178.

(See also Arches; Concrete; Dams; Grouting; etc.)

- Massachusetts Gas & Electric Light Commission, Work of. Valuable report on lighting plants of the state. 1900, i-408.
- Massachusetts Institute of Technology. Proposed combination of, with Harvard University, A foreign opinion on. 1904, ii-594.
- Massachusetts State Board of Health, Proposed legislation to restrict powers of. 1904, i-153.
- Master Car Builders' Association:
 - Conventions. 1900, i-424, 428; 1901, i-476; 1901, ii-6; 1902, i-524; 1903, ii-45; 1904, i-616; 1904, ii-9.
 - Steel car question. 1904, i-4.
- Masts, Steel, for ships, made by Fore River Ship & Engine Co. 1904, ii-*37.
- Masurite, a high-power explosive. 1902, i-257.
- Mattress construction:
 - Mississippi River. Bank revetment of the lower part of the river. By Charles Le Vasseur, 1901, ii-*322.
 - Missouri River, Chicago & Alton Ry. By W. R. DeWitt, 1902, i-*450.
- Maximite:
 - Experiments at Sandy Hook. 1901, i-257.
 - High explosive for armor piercing projectiles, Tests of. 1900, ii-*292.
- Measurement, Standards of, in field engineering. By Benjamin Franklin, A. E. Duckham, 1901, ii-203, 283.
- Measuring load of a vessel. (See Scows, Measuring load.)
- Measuring machine, Rogers. 1902, i-165.
- Mechanical science, Some refinements of. By Ambrose Swasey, 1904, ii-529.
- Mechanical stokers. (See Stokers.)
- Medical and surgical kits for engineers: a symposium. By H. E. Ashley, G. K. Erben, D. J. Hauer, Ernest McCullough, H. M. Wilson, 1903, i-13, 404, 538; 1903, ii-101.

* denotes an illustrated article. † denotes an inset sheet.

Megaphone with siren whistle. 1900, i-1.

Melville, George W., Rear-Admiral. Retirement of, as Engineer in Chief of the U. S. Navy. By W. M. McFarland, 1903, ii-98.

Mercury vapor tube patents, Cooper-Hewitt. 1901, ii-329; 1903, ii-89, 231.

Meridian, Obtaining the true, by daylight. By T. P. Perkins, 1904, i-307.

Metallic packing. Principles of design essential for successful development. By Charles Longstreth, 1903, ii-*119.

Metallurgy, Chlorine in. By James Swinburne, 1904, ii-304.

Metals, Aluminothermic production of pure, Goldschmidt process. 1904, i-406.

Meter boxes. (See Water meter boxes.)

Meters. (See Electric meters; Dynamometers; Water meters; Water wheel meter.)

Metric system:

American Society of Heating & Ventilating Engineers, Letter-ballot vote of. 1904, i-80, 85.

American Society of Mechanical Engineers, Results of letter-ballot. 1903, ii-9.

British Empire. Replies from various provincial governments. 1904, i-303.

Compulsory, on government work. 1902, i-192, 230, 274.

Contractions. Table from "Molesworth's Metrical Tables." 1900, i-131.

Discussion by F. A. Halsey. Persistence of old units in foreign industries.

Discussion before American Society of Civil Engineers. Arguments for and against. By F. A. Halsey, G. C. Henning, C. T. Porter, C. W. Baldridge, B. H. Brough, F. Lavis, H. E. Ashley, E. S. Gould, T. A. Corry, F. A. Mahan, 1902, ii-349, 350, 371, 492, 501, 509, 524, 540, 541; By D. M. Andrews, C. T. Porter, W. C. Hammatt, Arthur Lagron, A. S. Robinson, Ernest McCullough, E. L. Corthell, J. W. Miles, S. W. Stratton, J. C. Troutwine, 3d, E. M. Malmquist, A. G. Webster, C. R. Coutlee, A. T. Hubbard, B. Schreiner, C. W. Haines, 1903, i-37, 39, 59, 105, 128, 129, 153, 176, 238, 452.

Introducing metric nomenclature. 1902, ii-524.

Napoleon and the metric system. By S. M. Kielland, 1903, ii-544.

National Association of Manufacturers, Ballot by. 1904, i-48.

Opposition to bill in Congress for compulsory use of metric system. F. A. Halsey's argument. 1904, i-184.

Progress in the United States. 1900, i-304, 310.

Shipbuilding industry and the metric system. 1903, ii-482.

Society of Naval Architects and Marine Engineers, Resolution of, against adoption of bill in Congress. 1903, ii-482.

United States. Franklin Institute Report. 1902, i-165.

Mexico:

Opportunities for young engineers. By J. M. Alarco, 1901, ii-62.

Trip of American Institute of Mining Engineers to Mexico. 1901, ii-395, 405, 437, *464.

Michigan, Valuation of railway and other corporate property in. 1900, ii-430.

Michigan Engineering Society, Convention. 1902, i-48.

Microphotographic analysis of materials at the Westinghouse Machine Co. By J. R. Bibbins, 1904, i-*213.

Mile post, Concrete, Chic. & East. Ill. R. R. 1903, i-*18.

Miles per hour into feet per second, Rule. 1900, i-26.

Mills. (See Shops and factories.)

Mine cages, Oliver Iron Mining Co., Ely, Minn. 1903, ii-*449.

Mine dams at Chapin mine, Michigan. By James MacNaughton, 1901, i-*215.

Mine explosions:

Coal Creek, Tenn., and Fernie, B. C. Dust explosions. 1902, i-480.

Deaths from. 1904, i-79.

Johnstown, Pa., July 10, 1902. Death of over 100. 1902, ii-41.

Pawnee, Ill. Dust explosion Oct. 13, 1902. 1902, ii-305.

Red-Ash Colliery, Fayette Co., West Virginia. By W. N. Page, 1900, ii-*361.

"1900, ii-112" means "Year, 1900, second volume, page 112."

- Mine pumping plants. (See Pumping engines; Pumps.)
- Mine shaft. (See Shaft; Shaft sinking.)
- Mine timbering, Cost of square set, in mines of Rossland, B. C. By B. C. Yates, Bernard MacDonald, 1902, ii-377, 502.
- Mine ventilating fans, Tests of. By R. V. Norris, 1904, ii-*410.
- Mineral production of the United States:
1890 to 1899 inclusive. 1900, ii-390.
Statistics for 1900. Value of mineral products, 1880-1900. 1901, ii-311.
Report of United States Geological Survey. 1904, ii-439.
- Mineral resources. Coming exhaustion of nature's stores. 1901, i-80.
- Minerals, Curious list of. 1902, ii-380.
- Miner's inch of water. Experiments at the hydraulic laboratory of McGill University. Miner's inch in British Columbia. 1900, ii-404.
- Miner's inch in the revised Trautwine's pocket-book. 1903, i-Eng. Lit. Sup., Jan. 15, Feb. 19.
- Mines:
Bingham, Utah, United States Mining Co. By W. P. Hardesty, 1904, i-*121.
Copper mines of Arlington, N. J. 1901, i-72.
Iron mines at Belle Isle, Canada. 1900, ii-187.
Melones Mine, Calaveras County, Cal. Mining and milling costs and methods. By Frank Langford, 1903, i-*288.
Salt mines of Grand Cote Island, Louisiana. Shaft sinking. By J. N. Hazlehurst, 1901, ii-*342.
Scotfield, Utah. Dust explosion. 1900, i-325.
Sulphur, San Rafael, Mexico. By H. L. Cumming, 1900, ii-334.
Vermillion and Mesabi mines. Through the mines with the American Institute of Mining Engineers. 1904, ii-306.
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- Mining:
Books on mining. 1903, i-Eng. Lit. Sup. May 14.
Cost of copper mining in Lake Superior District, 1901, 1902, ii-473.
Cost of mining by the "hole contract system" at Rossland, B. C. 1902, ii-483.
Costs and methods of mining and milling at Melones Mine, Calaveras County, Cal. By Frank Langford, 1903, i-*288.
Electrical equipment of mines, Consolidated California & Virginia Mining Co., C. & C. shaft. By L. M. Hall, 1902, ii-*132.
(See also Pumping plants; Pumps.)
- Gold mining. (See Gold.)
- Hydraulic:
Briseis tin mines in Tasmania. Notes on water-works. 1903, i-55.
Cost of hydraulic excavation for placer mining. 1902, ii-438.
Cost of hydraulic excavating and mining in California. 1903, i-11.
Retaining barriers for the debris in the Yuba River, Cal. 1903, i-*52.
Winding ropes, Testing of, in the province of Anhalt, Germany. By F. H. Probert, 1901, i-125.
- Mining and metallurgical exhibits at the Paris Exposition. 1900, ii-*48.
- Mining cartridge, Tonge hydraulic, for breaking down coal in mines without use of explosives. 1902, ii-225.
- Mining Congress. (See American Mining Congress.)
- Mining lamp, Baldwin acetylene. 1901, ii-*285.
- Mining laws. Defects in the Federal laws governing mineral locations. 1902, ii-380.
- Mining valuation by mining experts. Discussion by R. W. Raymond at American Institute of Mining Engineers. 1902, ii-361.
- Mixers, Hot metal. By A. C. Johnston, 1902, i-*267, *358.
- Mixing cement and concrete. (See Cement mixing; Concrete mixing.)
- Modeling in plaster of Paris. 1903, i-327.
- Modern Steel Structural Co., Waukesha, Wis. New works and special machinery. 1902, ii-*100.
- Moisture proof. (See Waterproofing.)

* denotes an illustrated article. † denotes an inset sheet.

Mold car for use at copper converters, Globe, Arizona. 1904, i-*443.

Molding machines:

Cement pipe. Kielberg molding press. 1903, ii-*33.

Cement-sand bricks. Cement Products Co. 1904, ii-*443.

"Squeezer" or hand press type. By S. H. Stupakoff, 1903, i-*542.

Molding of test pieces and standard specifications for gray iron castings. 1901, ii-*76.

Molds. (See Concrete molds.)

Molecular conductivity. 1904, i-350.

Moment of inertia, Polar. Application to riveted connections. By C. F. Blake and R. W. Runge, 1903, i-*461.

Momentum grades. Some comments on their literature and their probable future use. By W. D. Taylor, 1904, i-410.

Monitors. (See Warships.)

Montauk Point as a freight terminal. 1902, ii-112.

Monte Cristo, Wash., Ore formation at. Questionable theories of J. E. Spurr. 1903, i-13.

Monuments. (See Surveys.)

Moore, Robert, Biographical sketch of. 1902, i-†42.

Morgan, Charles Hill. Biographical sketch of. 1900, i-†46.

Mortar:

Carbonate of soda in mortars used in freezing weather. Swiss experiments. 1902, i-335.

Fireproof mortar for furnaces, etc. 1902, i-215, 276.

Retempering cement mortar. Tests at Manhattan Ry. Co.'s power station, New York. By T. S. Clark, 1902, ii-67, 114.

Salt, Effect of too much, in lime mortars. 1904, ii-595.

Strength and efficiency of mixtures of lime and cement in mortars. 1904, ii-22.

Tests of mortar made of cement and limestone screenings. Report of Highway Division of Maryland Geological Survey. 1902, i-375.

(See also Cement; Concrete.)

Morton, Henry, Biographical sketch of. 1902, i-*391.

Mosquito extermination:

Conference in New York City, Dec., 1903. 1903, ii-510, 559, 567.

Discussion. By H. C. Weeks, 1902, ii-13.

New York rules. 1903, ii-152.

Relation of, to engineering. 1904, ii-595.

Report issued by the North Shore Improvement Association, Long Island. 1902, i-502.

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Motor vehicles:

Alcohol-motor draft-wagon, Prizes offered for, in Germany. 1902, i-355.

Aluminum, Quimby & Co., Newark. 1902, ii-79.

California Mobile Rapid Transit Co., San Jose, and a rural passenger service. 1902, i-61.

Electric Vehicle Co., Finances of. 1901, ii-176.

Exhibition in Berlin, Germany. 1903, i-408.

Exhibitions in New York. Automobile: a machine for assisting people of wealth to dispose of their surplus money. 1900, ii-337; 1903, i-103.

Freight vehicles. Endurance test in New York City. 1903, i-465.

Gasoline motor ash wagon, Trial in New York. 1902, i-151.

Grass mower built by Deering Harvester Co. 1901, ii-81.

Highway system proposed in New Hampshire, about 500 miles long. 1900, i-337.

History of the motor wagon. Steam wagon best adapted to transportation of heavy loads. By Arthur Herschmann, 1900, i-349.

Municipal vehicles for collection of refuse, street cleaning etc., England. Report on the use of, by the Bermondsey Borough Council. By T. W. Higgins, R. G. Angel, 1903, ii-137.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Motor vehicles: (Continued.)

- New York, Fifth Ave. Coach Co. 1900, ii-101.
- Omnibus motor vehicles as feeders to railway lines. 1903, ii-364.
- Race on Staten Island. Baker machine. Serious accident. 1902, i-449.
- Regulation of, in Great Britain. 1903, ii-121.
- Relay station route, Seabright to Atlantic City, N. J. 1900, i-287.
- Reliability trials by Automobile Club of England. 1903, ii-193.
- Road train, French invention. 1904, i-127.
- Speed records at Nice. 1903, i-313.
- Steam vehicles, Increasing popularity of. 1900, ii-354.
- Steam wagon for Adams Express Co., Bridgeport, Conn. 1902, i-381.
- Street cleaning vehicles, English practice. 1900, i-273.
- Trials of vehicles at Liverpool, England. 1900, i-246; 1901, ii-41, 129; 1902, i-111.
- Wear of roads by vehicles. 1903, ii-412.
- Wheels, Design of. 1900, ii-388.

Motors. (See Compressed air motors; Current motors; Electric motors; Gasoline motor; Solar motors; Steam motors.)

Mountain, Highest in the United States. By C. W. Comstock, 1904, ii-364.

Mule haulage in coal mine, Cost of. By B. S. Randolph, 1903, i-539.

Multiplication. (See Checking arithmetical calculations.)

Municipal accounts, reports and statistics:

- British report on municipal trading and municipal accounting. 1903, ii-198, 202.
- Notes from. 1900, ii-448.

Municipal accounts, reports and statistics, Uniform:

- American Economic Association report. 1901, i-40.
- Gas and electric lighting companies. By J. B. Cahoon, 1900, i-391.
- Massachusetts, Bill in legislature. 1903, ii-25.
- National Municipal League, Discussions at. 1900, ii-171, 219; 1901, i-359.
- Ohio state law. New system. 1903, i-476.
- Progress made toward uniform statistics by various organizations. By H. B. Henderson, 1900, ii-8, 12, 94; 1902, ii-336.
- Relation of uniform accounting to comparative municipal statistics. By L. G. Powers, 1904, i-429.
- Springfield, Mass. Good bookkeeping in the Water-Works Department. 1900, ii-354.
- Uniform accounting a prerequisite to national municipal statistics. 1900, i-393.
- Wyoming. State law. By H. B. Henderson, 1900, ii-94.

Municipal construction. Advantages over contract system. 1903, ii-347.

Municipal corporations, Engineering societies as advisers to. Municipal engineering in Chicago. By L. E. McGann, 1900, i-24, 30.

Municipal Engineers of the City of New York vote for the Union Engineering building. By Wisner Martin, 1903, i-503.

Municipal government:

- Battersea borough of London, and John Burns. 1904, i-394.
- Charters. Engineering and allied features of the proposed charter for Atlanta, Ga. 1902, ii-61, 64, 97.
- Contract system in Baltimore. Board of Awards. 1902, ii-173.
- Engineer, Position of, in municipal service. 1901, ii-420, 428.
- Growth of interest in municipal affairs. By C. R. Woodruff, 1900, ii-194.
- Instruction in University of Wisconsin and in the Society of Arts, England. 1900, ii-92.
- Limitations to "home rule." Speech by Mayor Rose of Milwaukee. 1903, i-150.
- Municipal program. By D. F. Wilcox, 1904, i-421.
- Municipal program essential to symmetrical and continuous city development. 1902, ii-48.
- Nomination system. 1904, i-420.

* denotes an illustrated article. † denotes an inset sheet.

Municipal government: (Continued.)

St. Louis, Mo. Exposure of municipal corruption by Circuit Attorney Folk. 1902, ii-424.

Taxation. By Lawson Purdy. 1904, i-419.

Training of health officers. Sanitary engineering course in Engineering schools. 1901, ii-8.

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Municipal improvements:

Atlanta, Ga. 1901, i-74.

Birmingham, Ala. 1901, i-114.

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Chattanooga, Tenn. 1901, i-*162.

Cincinnati, Ohio. 1901, ii-*22.

Great Britain, First impressions of municipal work in. 1904, i-347, 352.

Milwaukee, Wis. 1901, i-187.

Municipal program essential to symmetrical and continuous city development. 1902, ii-48.

Systematic plan for the æsthetic development of a city. 1902, ii-146.

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Municipal ownership:

Asphalt plant at Winnipeg, Manitoba. Costs for 1899 and 1900. 1901, i-261, 264.

Books against municipal ownership. 1903, i-Eng. Lit. Sup. Feb. 19.

British report on municipal trading and municipal accounting. 1903, ii-198, 202.

Chicago, Referendum vote in. 1902, i-285.

Electric lighting plants:

Brookhaven, Miss. Operating expenses and revenues. By Granbery Jackson, 1901, i-434.

Chicago. Costs, 1887-1900. Compared with estimated cost under private contract. By E. B. Ellicott, 1900, ii-425; 1901, i-317, 320.

Detroit, Mich. Position of the engineer in municipal service. Profits. By Alexander Dow, 1901, ii-420, 428; by J. E. Lockwood, 1903, i-212, 277.

Holyoke, Mass. 1902, ii-137.

Massachusetts Gas & Electric Light Commission. Valuable reports on plants in State. 1900, i-468.

New Orleans. City ordinance. 1902, ii-137.

New York City. (See Electric lighting, New York City.)

Orillia, Ontario. 1903, ii-402.

Richmond, Ind. By J. B. Nelson, 1903, i-99.

Wallingford, Conn. Cost of service. By T. C. Perkins, 1900, ii-424.

Electric power plant, Richmond, Ind. By J. B. Nelson, 1903, i-99.

Gas works. (See Electric lighting, New York City.)

Great Britain. Papers by R. B. Porter and Robert Donald before National Committee on Municipal Ownership, in New York, Feb., 1903. 1903, i-211.

National convention on municipal ownership and public franchises. 1903, i-211.

Street railways:

Birmingham, England. 1903, i-313.

England. 1900, i-120.

Illinois. Report of Commission. Bill before City Council of Chicago. 1901, i-1, 28, 39, 57; 1903, i-421, 465.

Water-works:

Augusta, Me. 1903, ii-1.

Austin, Texas. 1902, ii-157.

Denver, Colo. 1901, i-113, 385.

London. Proposed by bill in Parliament. 1902, i-178; 1903, i-441.

Los Angeles, Cal. 1901, ii-81, 185; 1902, i-141.

"1900, ii-112" means "Year, 1900, second volume, page 112."

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Maine. 1903, i-477.

Omaha, Neb. 1900, i-185.

San Francisco, Cal. 1900, i-281; 1900, ii-232.

Tullahoma, Tenn. 1903, i-536.

United States, Progress in. 1903, i-566.

United States. Municipal and private ownership of water, gas and electric light plants. 1900, ii-92; 1902, i-293.

Winnetka, Ill. 1903, ii-100.

Municipal Year Book, 1902. B. M. N. Baker, 1902, ii-62.

Mutual benefit association. (See Labor question.)

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Nails:

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Durability of wrought iron. 1903, ii-592.

Naphtha residue in the manufacture of iron and steel in Russia, called mazout. 1901, ii-407.

National Bureau of Standards. 1902, i-125.

National Electric Light Association, Conventions. 1900, i-368; 1902, i-442; 1903, i-505.

National Fire Protection Association, Convention. 1901, i-455.

National Irrigation Association, Convention. 1900, ii-378.

National Municipal League, Conventions. 1900, ii-219; 1901, i-356, 359; 1904, i-419.

Natural gas:

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Contract work. Criticism of methods employed in letting naval contracts. 1902, i-255, 276, 310.

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Draftsmen, Rules governing the employment of. 1901, ii-18.

Engineers. (See Engineers, Naval.)

National naval reserve planned by board of naval officers. 1901, i-1.

Steam engineering corps, Proposed changes in. 1904, ii-544.

Titles. Use of line titles by staff officers. 1904, ii-575.

World's navies:

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Nernst lamp, Use of, increasing. 1903, ii-69.

New England Cotton Manufacturers' Association, Convention. 1902, ii-288.

New England Water-Works Association:

Constitution, Revised. Publication of papers in advance. 1900, ii-180.

Conventions. 1900, ii-218; 1901, ii-224; 1902, ii-210, 212, 216; 1903, i-82; 1903, ii-237; 1904, ii-259, 287.

New Jersey State Sanitary Association, Conventions. 1900, ii-407; 1901, ii-450

New York City:

Export trade. Report of Commerce Commission. 1900, i-76.

250th anniversary. 1903, i-476.

New York State Sewerage and Water Commission. Bill proposing Commission in Legislature. 1904, i-80.

* denotes an illustrated article. † denotes an inset sheet.

Newspapers and their lack of information on technical subjects. 1902, ii-191, 192, 214.

Niagara Falls, Preservation of. 1903, i-346.

Nickel plating. By O. W. Brown, 1903, ii-266.

Nickel-steel:

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Notes on. 1903, ii-31.

Physical requirements for Blackwell's Island bridge. 1903, ii-202, 206.

Properties and possible uses of nickel-steel. 1900, i-112.

Nickel-steel tubes. (See Tubes.)

Noble, Alfred, Biographical sketch of. 1903, i-†90.

Nomenclature. (See Terms in engineering literature.)

Northern Securities Case. Legal decision. National Corporation Law suggested. 1903, i-346, 388.

Northwestern Electrical Association, Convention. 1900, i-64.

Nova Scotia. (See Iron and steel works.)

Nozzles:

Combination deflecting and needle nozzle. Tests. Efficient high-pressure plant in Southern California. By G. J. Henry, Jr., and J. N. LeConte, 1903, ii-†311.

Spraying nozzle for cooling and aerating water. 1903, i-†321, 325, 393.

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Ohio Society of Surveyors and Civil Engineers, Convention. 1903, i-97.

Oil:

Beaumont, Texas:

Boring methods. Apparatus for preventing waste of oil. Well bored by A. F. Lucas. 1901, ii-68.

Economic conditions. Year's development. By R. T. Hill, 1902, ii-272.

Notes on oil production. By R. T. Hill, 1903, i-407.

Storing crude oil in wells, to be tried in Arizona. 1903, ii-510.

Tests of lubricating oils. Testing machine and some of its results. By Albert Kingsbury, 1902, ii-†538.

Texas:

Eruption near Humble, Dec. 14, 1904. 1904, ii-577.

Production of petroleum in. 1901, ii-199, 353.

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Oil as fuel:

Analysis, Ultimate, of fuel oils. By E. L. Orde, 1902, ii-122.

Chicago Union Steam Traction Co. Use of oil abandoned. 1900, ii-141.

Cost of burning oil one-half that of coal. Experiment by water-works companies at El Paso, Texas. By H. T. Edgar, 1902, i-501.

Effect of fuel oil on long-distance electric transmission enterprises. 1902, ii-169.

Explosion on the steamer "Progreso." 1902, ii-513; 1903, i-25.

Handling fuel oil at railway terminals. Southern Pacific Ry. Discussion at Pacific Coast Railway Club. 1902, ii-232, 349.

Marine engines using oil fuel. By James McKechnie, 1901, ii-140; By Robert Haig, 1904, ii-473.

Methods of handling liquid fuel for steam raising. Los Angeles Electric Co. Experiments with burners at El Paso, Texas. By J. W. Warren and H. T. Edgar, 1902, i-501.

Results obtained on sea-going steamers. Figures showing actual consumption. By E. L. Orde, 1902, ii-124, 305.

Steam motor cars on French railway, Use of petroleum by. 1903, i-116.

Steamships:

Explosion of oil-burning steamer "Progreso." 1902, ii-513.

General discussion of subject. Ultimate analysis of fuel oils. Types of burners. Actual results obtained on sea-going steamer. By E. L. Orde, 1902, ii-†122, 305.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Oil as fuel:**Steamships: (Continued.)**

"Mariposa" and "Nevadan." 1902, ii-121, 157.

"Nebraskan" of the Hawaiian Steamship Co. Trip from California to New York. 1904, i-303.

Tested by the "Cowrie" during voyage of 9,250 miles. 1900, ii-305.

Value of oil compared with coal. By Lieut. C. L. Poor, 1902, ii-349.

Willamette and Columbia River steamers. 1902, ii-105.

Storage plants using oil, Report on. 1903, ii-396.

Tests, Comparative, of coal and crude oil as fuel. By J. E. Denton, of Stevens Institute. Report. 1902, i-*80.

Tests of Texas and California fuel oils by Southern Pacific Ry. By Howard Stillman, 1901, ii-23, 185.

Torpedo boats. Experiments by United States Navy Department. Oil less effective than coal for producing speed. 1900, ii-437.

(See also Locomotives, Fuel.)

Oil burners:

Best known types. Burners tested at sea. Combined oil and coal burning apparatus. Feeders using steam or compressed air for spraying. By E. L. Orde, 1902, ii-122.

Williams burner, used by J. E. Denton in his comparative tests of coal and oil as fuel. 1902, i-*80.

Oil cup for pressure oiling systems, Lunkenheimer. 1901, i-*164.

Oil engines. (See Gas and oil engines.)

Oil-feed system on power plant at St. Louis Exhibition. 1904, ii-227.

Oil gas. (See Gas.)

Oil pipe line of the United States Pipe Line Co. Pumping of oil from Bradford, Pa., to Marcus Hook on the Delaware River. 1901, i-129.

Oil pump for steam engine lubrication, Schaeffer & Budenberg. 1903, i-*98.

Oil separators:

Davis-Perritt, for removing oil from air pump discharge. 1904, ii-178.

Efficiency, Preserving. 1902, ii-510.

Exhaust steam separators, German. 1902, ii-*427.

Experiments on condensing plant of Edison Co., Detroit, Mich. By L. M. Booth, J. R. Bibbins, 1902, i-*406, 415, 437, 522; By A. W. Buel, 1902, ii-34.

Test of the "Utility" at Brooklyn Navy Yard by F. R. Hutton. 1903, i-356.

Working of separators investigated by C. Bach. 1903, i-249.

Olcott, Eben E., Biographical sketch of. 1902, i-†44.

"Old Oaken Bucket": Verses by Dr. James C. Bayles. 1901, ii-493.

Olmsted, Frederick Law, Death of. 1903, ii-202.

Ore bins. (See Bins.)

Ore classifier, Klein. 1903, i-*40.

Ore deposits:

Genesis of ore deposits, Practical suggestions. By Max Boehmer. 1903, i-528.

Monte Cristo, Wash. Questionable theories concerning formation. 1903, i-13.

Ore crushers. (See Stone crushers.)

Ore handling. (See Iron, Ore handling.)

"Ore in sight", Meaning of. Defined by the Institution of Mining and Metallurgy. 1902, ii-332.

Ore vessel with continuous hatches. 1904, i-*434.

Organization of manufacturing enterprises. By Andrew Carnegie, 1903, i-436.

Oxigine, a fuel stimulant. 1902, ii-395.

Oxygen, "Combustible". American Heat, Light & Power Co. 1900, ii-250.

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Packing goods for export. 1901, ii-102.

Packings, Metallic. Principles of design essential for successful development.
By Charles Longstreth, 1903, ii-*119.

Paint:

Cold water paints, Experience with. 1903, i-380.

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Fireproof. (See Fireproofed wood.)

Graphite paint a scale preventive for heating surfaces of steam boilers.
Experience of Detroit Graphite Mfg. Co. 1900, ii-168.

Iron work, Paint for. By G. W. Lilly, 1902, i-322, 332, 458.

Protection of ferric structures from corrosion. Iron oxide pigments. Boiled oil vs. pigment coatings. Asphaltum coatings. Linseed oil. By M. P. Wood, 1901, ii-213.

Ship's bottom paints, Character and action of. By A. H. Sabin, 1900, ii-363.

Tests of various paints on the 155th St. viaduct, New York City. Results of examination by H. B. Seaman, Dec. 1901. 1902, ii-164.

(See also Cables, Waterproof wrapping; Iron and steel, Coatings.)

Painting:

Bridges and viaducts. Mixing and applying paint. Sand blast for cleaning paint. By G. W. Lilly, 1902, i-323, 332, 458.

Paint spraying machine used by F. E. Hook, of Hudson, Mich. 1903, i-380.

Painting and maintaining steel cars. By J. D. Wright, W. O. Quest, 1903, ii-315.

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Palisades of the Hudson River. Preliminary report of the Interstate Palisade Park Commission. 1901, i-1, 313.

Pamphlet literature, Value of. 1904, i-Eng. Lit. Sup. April 14, May 19.

Pantograph, Boston Universal. 1901, i-297.

Parcels post, American. Domestic and foreign trade advantages. Review of report by Mahlon A. Winter. 1901, i-34.

Paris, Streets and street plan of; a lesson in municipal esthetics. 1904, i-*525.

Paris Exposition. (See Exhibitions.)

Parks:

Boston. Water park in Back Bay basin. 1901, i-257.

City park of a medium sized town. 1904, i-87.

Columbus, Ga. Parking city streets. By R. L. Johnson, 1901, i-356, *363.

Proportion of city's area in parks and playgrounds. 1902, ii-311.

Patent litigation of Westinghouse Electric & Manufacturing Co. vs. Orange County Gas & Electric Co. 1902, ii-461.

Patent Office of the United States, New classification in. 1901, i-100.

Patents:

Aluminum production processes. 1903, ii-390.

"Engineering's" record of patents. Cow-tail holder. 1901 i-336.

Engineers and patents. 1901, ii-197; 1902, ii-112.

"Pavement, The vicissitudes of a." 1904, i-406.

Pavement guarantees. By G. W. Tillson, 1901, ii-271.

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Albany, N. Y. Brick pavement foundation. Concrete. Sand. By Horace Andrews, 1900, i-254, 276.

Asphalt:

Cost in 47 cities during 1900, including base, binder and wearing surface. Compiled by F. V. E. Bardol, Buffalo, N. Y. 1901, i-139.

Cost of maintaining asphalt pavements of various ages in Washington, D. C. By H. C. Newcomer, 1904, i-165.

Cost, endurance, repairing, etc. "Relation of the character of the asphalt to the wearing properties of an asphalt pavement." By S. Whinery, Clifford Richardson, 1904, i-444, *519.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Pavements:**Asphalt: (Continued.)**

- Failures in pavements and their causes. Disintegration by cracking, from rolling, or crowding and in spots. By A. W. Dow. 1900, i-222.
- Geneva, N. Y. Tar macadam and asphalt plant. 1902, ii-435.
- London, Report on life of pavement in. 1900, i-363.
- New York City. Proposed changes in the paving specifications. Report by Otto H. Klein. Criticisms. Municipal repair plant recommended by Grand Jury. Repairs in other cities. By A. W. Dow, 1902, i-112, 119, 121, 158; 1903, ii-112, 152.
- Port Neches, Texas. Paving plant. 1901, ii-441.
- Resistance to traction. By S. Whinery, 1903, ii-380.
- Slipperiness of asphalt. Experiments in Boston with the Paris system of washing asphalt. 1901, i-409.
- Slipperiness of asphalt French pavement at Paris Exposition. Sharp pieces of stone embedded in asphalt. 1900, ii-73.
- Specifications adopted in New York City. 1904, i-539.
- Testing of bitumens for paving purposes. By A. W. Dow, Clifford Richardson, 1903, ii-59, 72, 123.
- Water, Action of:
- Discussion. By A. W. Dow, Clifford Richardson, 1903, ii-59, 74.
 - Experiments on different asphalts at Mt. Prospect Laboratory, Brooklyn. By G. C. Whipple and D. D. Jackson, 1900, i-187.
 - Experiments with sheet and block asphalt from various cities. Tests by immersion and by freezing. By D. B. Luten, 1900, ii-*113.
- Winnipeg, Manitoba. Municipal plant. Costs for 1899 and 1900. 1901, i-261, 264, 308.
- Asphalt block, Magdeburg, Germany. Successful. 1903, ii-193.
- Asphalt-macadam:
- Hamilton, Ohio. Experience. By H. W. Ash, 1901, ii-10.
 - Paris Exposition. French pavement. Sharp stone embedded in asphalt. 1900, ii-73.
 - Whinery's method. Proposed construction of asphalt-macadam. By S. Whinery, 1901, i-413, 417.
 - Whinery's method compared with F. J. Warren's method. By H. W. Ash, 1901, ii-10.
- Asphalt repairs:
- Chattanooga, Tenn. Portable plant. 1901, i-*162.
 - Cracks, Repairing. 1900, ii-430.
 - Dayton, Ohio, plant. 1903, ii-434.
 - Municipal plant recommended by Grand Jury, for New York City. Conditions in other cities. 1903, ii-112, 152.
 - Rochester, N. Y. Cost of repairs, 1897 to 1902. 1902, ii-311; 1903, ii-386.
 - St. Louis plants, Municipal and private. By E. A. Hermann, Charles Varrelmann, 1903, ii-505.
 - Toronto, Ont. Repair costs. 1902, ii-436.
 - Washington, D. C. Cost of maintaining pavements of various ages. By H. C. Newcomer, 1904, i-165.
- Bacterial studies of the healthfulness of street pavements, Lafayette, Ind. By G. W. Tillson, D. B. Luten and Severance Burrage, 1900, ii-*242, 357, 410.
- Baltimore. Notes on various kinds of street paving. 1902, ii-173.
- Bellefontaine, Ohio. Concrete pavements. By F. H. Eno, 1904, i-*15.
- Binders, Experiments with, Providence, R. I. 1902, i-158.
- Birmingham, Ala. Improved streets macadamized with chert. 1901, i-115.
- Bitulithic pavement, Warren. 1903, ii-387.

* denotes an illustrated article. † denotes an inset sheet.

Pavements: (Continued.)

Brick:

Albany, N. Y. Foundations, concrete or sand. By Horace Andrews, 1900, i-254, 276.

Concrete foundations and cement filler. A comparison of natural cements and Portland. By O. L. Gearheart, 1904, i-87, 113.

Costs:

Champaign, Ill. Concrete curb and gutter. Concrete base for pavement. By Charles Apple, 1903, i-555.

Cost of laying brick in cents per square yard. 1902, ii-312.

Estimating number of brick required. Cost of labor. Cost of repaving. By I. O. Baker, H. P. Gillette, T. E. Petrie, 1902, ii-69, 98, 130, 170.

Country road. Underdrains. Foundation of broken vitrified pipe. Vitrified clay curbing. By Samuel Huston, 1902, ii-*233.

Elwood, Ind. Canton brick on foundations of broken stone and gravel. 1901, i-140.

Expansion of brick. View of raised strip of brick pavement, with cement grout filler, Indianapolis, Ind. By D. B. Luten, 1901, i-*193.

Foundation of concrete. By W. H. Tarrant, 1901, i-96.

Ithaca, N. Y. Cost and durability. 1901, ii-144.

Manner of laying modern brick pavement. Concrete foundations. By W. H. Tarrant, 1901, i-96.

Number of brick per square yard, Table for estimating. By H. P. Gillette, 1902, ii-69.

Repairing, Cost of. By H. P. Gillette, 1902, ii-69.

Specifications at Wheeling, W. Va. 1902, i-177.

Street railway track. Special form invented by W. H. Arthur and used at Stamford, Conn. 1904, i-*96.

Tests of brick at Middletown, Ohio, by Frank Doty. Immersion in water. 1900, ii-141.

Wearing power of paving brick, Influence of structure on. Investigation by National Brick Manufacturers' Association. 1900, ii-96.

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Brooklyn. Inspectors of paving, with a technical knowledge wanted. 1902, i-321.

Champaign, Ill. Cost of brick pavements. By Charles Apple, 1903, i-*555.

Charleston, S. C. Character of streets paved and unpaved at close of 1899. Costs. 1901, i-23.

Chattanooga, Tenn. Asphalt, brick and chert. Portable asphalt repairing plant. 1901, i-163.

Chert at Chattanooga, Tenn. 1901, i-163.

Chicago, Defective work in. 1900, i-163.

Cincinnati, Notes on various paving material used in. 1901, ii-23.

Columbus, Ga. Shell rock macadam satisfactory. 1900, ii-449.

Columbus, Ohio. Cost of paving. 1902, i-165.

Concrete:

Bellefontaine, Ohio. By F. H. Eno, 1904, i-*15.

Foundations, Portland and natural cement. By C. H. Rust, 1901, ii-271.

Grand Rapids, Mich. 1902, ii-436.

New Orleans, La. Partial failure of pavement between car tracks. Letters by W. J. Hardee. 1903, ii-270.

Proposed cheap and durable pavement. By S. Whinery, 1904, ii-56, 72.

Richmond, Ind. By H. L. Weber, 1904, i-*84.

Toronto, Canada. By C. H. Rust, 1904, ii-227, 239.

Concrete curb and gutter and concrete base for brick pavement, Champaign, Ill. 1903, i-*555.

Concrete macadam pavement proposed at Athens, Pa. 1903, ii-184.

Crowns, Standard, Omaha, Neb. Table and diagram. 1902, ii-*420, 501.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Pavements: (Continued.)

Design of economic streets and pavements. By H. P. Gillette, 1901, ii-165.
 Detroit, Mich. Street paving guarantees, except on asphalt work, abandoned. Cedar blocks in favor. Wood sidewalks. 1900, ii-449.

Foundations:

Brick pavement at Albany, N. Y. Experience with concrete. By Horace Andrews, 1900, i-254, 276.

General discussion. By S. Whinery, 1903, ii-404.

Slag macadam at Akron, Ohio. 1903, ii-268.

Glass paving blocks, Paris experiments with. 1901, i-353.

Grand Rapids, Mich. Notes on concrete pavement, curbs and sidewalks. 1902, ii-436.

Guarantees, Contractors'. By S. Whinery, 1903, ii-406, 432.

Gutter in center of street, Trinidad, Cuba. By G. G. Fischer, 1903, i-505; 1903, ii-13.

Havana, Cuba:

Macadam streets. Various kinds of pavement tested. From report of General Ludlow. 1901, i-†90.

Plans for new paving. 1900, ii-117, 273, 300; By W. J. Barden, 1901, ii-10, 334, 341, 357, 377.

Indianapolis, Ind. Notes. 1903, ii-386.

Iron stone dust with trap-rock macadam. 1901, ii-329.

Lafayette, Ind. Bacterial studies of the healthfulness of street pavements. By G. W. Tillson, D. B. Luten and Severance Burrage, 1900, ii-*242, 357, 410.

Life of street pavements. By S. Whinery, 1903, ii-369.

Macadam as a pavement foundation. Experience in Washington, D. C., and other cities. By T. C. J. Baily, Jr., 1903, i-325, 347, 476.

Macadam legally a pavement, Perth Amboy, N. J. 1903, ii-232.

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Maintenance specification. 1903, ii-Cons. News Sup. Sept. 3, 17.

Measuring street work on steep grades. By John McNeal, Jr., 1902, ii-34.

New Orleans. Asphalt laid on old gravel streets. 1902, ii-461.

New York City. Injunction against asphalt contracts of National Asphalt Co. 1901, ii-441.

(See also above, Asphalt.)

Observations on street pavements. Statistics, life, censuses of street travel, resistance to traction. By S. Whinery, G. H. Norton, 1903, ii-369, 378, 404, 592; 1904, ii-56, 72.

Omaha, Neb. Table and diagram of stranded crowns. 1902, ii-420.

Portland, Oregon. Mileage of various kinds of pavement. 1904, i-265.

Railway stock pens. 1901, i-12.

Repaving, Cost of. By H. P. Gillette, 1902, ii-69.

Resistance to traction. By S. Whinery, 1903, ii-378.

Richmond, Ind. Cement roadways. By H. L. Weber, 1904, i-*84.

Rochester, N. Y. Mileage of different pavements. Cost of asphalt repairs. 1902, ii-310.

Rubber paving in London. 1904, ii-336.

Sandstone, Medina, in Brooklyn. 1903, ii-386.

Statistics of street paving. By S. Whinery, 1903, ii-369.

Stone block:

Cost of paving. By H. P. Gillette, 1902, ii-70.

Rochester, N. Y. Medina stone block. 1900, ii-171.

Tar-macadam in Glasgow. Experience unsatisfactory. 1901, ii-493.

(See also above, Bitulithic.)

Teamways, Pavement for, in ferry, boats, freight houses, pier sheds, etc. Experience in New York. 1903, i-254, 465.

Testing paving material, Tumbling barrel for, Paris. 1900, ii-*73.

Toronto, Canada. Notes on tar macadam and concrete. By C. H. Rust, 1904, ii-227, 239.

Traction of different vehicles on various level roads. Experiments. By I. O. Baker, 1902, i-*182.

* denotes an illustrated article. † denotes an inset sheet.

Pavements: (Continued.)

Traffic on American city streets. 1902, ii-312.

Washing. (See Street cleaning.)

Washington, D. C. Asphalt paving and cost of maintenance. By H. C. Newcomer, 1904, i-165.

Wheeling, W. Va. Specifications for paving brick, 1902, i-177.

Width of:

Advantages of narrow paved roadways. By S. Whinery, 1903, ii-405.

Athens, Pa. Trouble with citizens over reduction of width. By D. A. Keefe, 1904, ii-154.

Parking wide city streets. By R. L. Johnson, 1901, i-356, *363.

Reducing width, Advantages of. Discussion by H. E. Riggs. 1901, ii-7.

Why pave residence streets from curb to curb? 1903, ii-122.

Wood:

Boston, Beacon St. Treatment of wooden blocks. By F. A. Kummer, 1901, ii-49, 75, 107; 1904, ii-350.

Brown & Sharpe Mfg. Co.'s driveway. 1903, i-*160.

Combined granite and wood, Leicester, England. Satisfactory results. 1901, ii-49.

Duluth, Minn. Unusual wear in cedar paving blocks. 1903, ii-*166.

Experience at home and abroad. By B. T. Wheeler, F. A. Kummer, 1901, ii-271.

London:

Australian hardwood. Reply by Sir Edward H. Wittenoom to report by D. J. Ross, City Engineer of London. Defence of hardwood. 1900, ii-126.

Australian hardwood and creosoted deal pavements. By F. A. Kummer, 1901, ii-107.

Comparative durability of wood and asphalt pavements, reported on by City Engineer. 1900, i-353, 409.

Costs and wear. 1901, i-313.

Notes. 1902, ii-312.

Rectangular blocks in New York City. 1903, ii-386.

Testing wood paving blocks, Notes on, by F. A. Kummer. Specifications in Brooklyn. 1904, ii-359.

Tests in Boston. Strips of wood laid parallel with strips of asphalt. 1900, ii-305, 374.

Williamsburg bridge roadways. Steel underflooring. 1903, i-*464.

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Peat:

Briquette process in Germany. 1902, i-256.

Electrically carbonized peat fuel in Norway. 1902, ii-63.

Notes on Scandinavian peat-fuel. 1902, i-27.

Swedish methods of preparing peat-fuel. 1901, i-434.

Utilization of, as fuel. Raw peat briquetting press. Coking retort of "Economic" process. Producer for converting peat into gas. 1902, i-*476, 505.

Pebble-covered plains in desert regions, Origin of. By W. P. Blake, 1903, i-328.

Pencoyd Steel Works:

Output per man per annum in tons, at the Bridge Department. 1902, ii-113.

Talbot open-hearth continuous steel process. By Benjamin Talbot. 1900, ii-31.

Pens:

Dotting pen. Bow-pen with adjustable needle point. 1903, ii-*328.

"Lever" and "duplex" ruling pens. 1901, ii-429.

Penstocks and the speed regulation of turbines. By J. W. Thurso, 1903, i-28.

Perch of stone. 1904, ii-364.

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Leakage through sewer pipe joints. Experience of various cities and report of Massachusetts Board of Health. By J. N. Hazelhurst, Kenneth Allen, J. G. Richert, W. C. Hawley, E. W. Branch, 1903, ii-179, 182, 319, 391.

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 Newcastle, England. Electric railway power station. Raising condensing water. Tests of high-lift centrifugal pump driven by direct-connected motor, with turbine arrangement. By Charles Hopkinson, 1902, ii-*165.
 Pittsburg Reduction Co., New Kensington, Pa. By E. S. Fickes, 1901, i-*204.
 Prescott, Arizona. High pressure plant and force main. By W. W. Follett, 1902, ii-*514.
 Small water-works plants, Notes on. 1902, i-510.
 Utah Lake, Installation of plant. By W. P. Hardesty, 1903, i-*443.

Pumps:

- Air, Edwards. Diagrammatic section illustrating its operation. By Alexander Dow, 1902, i-*476.
 Air-chamber, Design of neck of. 1904, i-*331, *426.
 Air-lift:
 Efficiency trials of pumping plant for Birkenhead, England. 1904, i-595.
 Horizontal movement of water, Point Pleasant, Va. Water supply from beneath bed of Ohio River. Water moved both vertically and horizontally. 1900, ii-*359.
 Starrett pump. Ingenious and effective. 1904, ii-*476.
 Boiler feed-water pump for water at high temperatures. Nordberg engine. 1900, ii-*119.

Centrifugal:

- Buffalo Forge Co. Supplementary pumping plant for water-works of La Salle, Ill. Special design. 1904, i-*619.
 Characteristic curves. Determining capacity of electric motors for driving. By A. J. Bowie, Jr., 1903, ii-302, 414.
 Sulzer engine. High-pressure electrically-driven pumps in Spanish silver mine. 1902, i-*66, 68.
 Swiss pumps at Paris Exposition. 1900, ii-49.
 Tests, under high heads, of Jackson pumps. Electric Water Co., Bakersfield, Cal. Tabulated summary of tests. By L. A. Hicks, H. S. Wood, 1900, ii-*98, 110.

* denotes an illustrated article. † denotes an inset sheet.

Pumps:

Centrifugal: (Continued.)

Tests of high speed pumps by J. E. Denton and William Kent at works of De Laval Steam Turbine Co. Report. 1904, i-512.

300-H. P. two-stage pumps built by De Laval Steam Turbine Co., for Solvay Process Co., Trenton, N. J. 1904, ii-*312.

(See also below, Mine pumps.)

Drainage pump, Automatic motor driven, for manholes, cellars, pits, etc. By E. Guarini, 1904, i-*220.

Dredge pumps:

Centrifugal dredging pump designed to avoid excessive wear. Details designed by Thomas Middleton. Use at South West Pass of Mississippi River. By M. M. Patrick, 1903, ii-*26, 36.

"King Edward" pumps. By A. W. Robinson, 1903, i-*211.

Plunger pump for dredging and pumping gritty water. Bewsher Sand Pump & Dredging Co. 1903, i-*264.

Wear of pumps. Tests of different lining materials under action of a sand blast. New centrifugal pump. By M. M. Patrick, 1903, ii-*26, 36.

Electric:

Advantages of electric power in mining plants. Figures and comparisons in England and America. 1902, ii-236.

Centrifugal pump at water-works near Geneva. 1900, i-391.

Chicago, Bridgeport Station. Five rotary or impeller pumps, Connerville Blower Co. 1903, i-25, *172.

Fire protection and elevator service. Quimby screw pump, direct-connected. Results of tests. By F. A. Pattison, 1901, ii-*4.

Electric high speed, Blake & Knowles. Tested at Schenectady. 1904, i-611.

Fire pumps:

Portable electric, Rouen, France. 1902, ii-413.

Reports at National Fire Protective Association. Specifications for electric, rotary and steam pumps. 1901, i-*443.

High-lift centrifugal pump and turbine arrangement, direct-driven, for raising condensing water to electric power station, Newcastle, England. By Charles Hopkinson, 1902, ii-*165.

Leitch boiler feed pump with variable stroke. 1902, i-*492.

Mine pumps:

Horcajo, Spain. Four-stage high pressure centrifugal electrically-driven pumps in silver mines. Sulzer Bros. Figures as to the operation of pumping plant. 1902, i-*66, 68; 1902, ii-196.

Priming centrifugal mine pumps handling muddy water. By B. H. Heyward, E. F. Doty, R. S. Prindle, 1902, i-174, *214, 277, 312.

Moore pump, Operation under 175 feet of water. 1901, i-286.

Non-corrosive pump for a salt-water aquarium wanted. 1903, ii-246.

Oil pump for steam-engine lubrication. Schaeffer & Budenberg. 1903, i-*98.

Quimby screw pump direct-connected with electric motor for elevator service and for fire protection. By F. A. Pattison, 1901, ii-*4.

Rotary:

Johnson pump with sliding blades. 1900, i-*152.

Raywood Rice Canal & Milling Co., Liberty Co., Texas. Six pumps of 50,000 gallons per minute capacity. 1900, i-185.

Two-lobe cycloidal pump, Discussion of. By J. T. Wilkin, 1902, ii-*496.

Slippages in pumps in a number of cities as determined by pitometer measurements. From report of E. S. Cole, made to City Engineer of Chicago. 1904, ii-538.

Snow duplex pump, Operation under 80 feet of water, at Leadville mine. 1901, i-217, 286.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Pumps: (Continued.)

- Steam pump. Erwin steam ram for use in wells. Penberthy Injector Co. Results of tests. 1900, i-*335.
- Steam turbine driven centrifugal pump, Possibilities of. By A. Rateau, 1904, i-540, 547.
- Steam vacuum pump with positive valve motion. Emerson Pump Co. 1901, ii-*334.
- Suction air chambers, Comparative value of different arrangements of. By F. M. Wheeler, 1900, ii-*414.
- Tables for computing compound duplex steam pumps. By C. J. Mitchell, 1904, ii-434.
- Tests of high-speed centrifugal pumps by J. E. Denton and William Kent at works of De Laval Steam Turbine Co., Report on. 1904, i-512.
- Turbine pumps:
- Jackson high-pressure multi-stage turbine pumps with special balancing device. 1904, i-*324.
 - Switzerland pumps. By J. W. Thurso, 1902, ii-*463.
 - Turbine pumps and open wells. Self-contained gravel strainer. Corrosion of deep-well fixtures. By D. H. Maury, 1904, ii-*138, 151.
- Wheel pump for lifting sewage and storm water. 1901, ii-*151.

Punching machines:

- Caskey pneumatic. Portable punch operated by combined air and hydraulic pressure. 1902, ii-*420.
- Hydraulic punches for bridge and shop work. By G. L. Gillon, 1901, i-*95.
- John's machine manufactured by Henry Pels & Co., Berlin. 1901, ii-*376.
- Portable plate-slotting machine, German invention. 1901, ii-*395.

Pyrometers:

- Optical, exhibited by Dr. L. Waldo of New York. 1902, ii-332.
- Recording air pyrometer to measure temperatures of high ranges, Bristol. By W. H. Bristol, 1900, ii-*411.

Q.**Quarrying:**

- Air compressor and steam power plant at Lakeside, Ohio. 1901, ii-*164.
- Compressed air plant at Cleveland Stone Co. By L. I. Wightman, 1904, ii-*2.
- Cost of quarrying rubble and dimension stone for the Buffalo, New York, breakwater. By Emile Low, 1904, ii-*347.
- Drill-bit and wedge. Plymouth power wedge hole cutter. Ingersoll-Sergeant Drill Co. 1901, ii-320.
- Stone quarrying at Windmill Point, Ontario. 1901, i-*350.
- Quartz, Fusion of, in the electric furnace. By R. S. Hutton, 1902, ii-231.
- Quicksand, Forcing cement into. By R. C. Beardsley, 1902, ii-316.

R.**Rack railways:**

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- Mont Blanc railway. Electric locomotive. 1904, ii-266.
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Radiators:

- Hot air radiator and a closed piping system. By G. M. Aylsworth, 1903, ii-*111.
- Test of radiators with superheated steam. By R. C. Carpenter, 1901, ii-37.

Radium, a new metal. 1901, ii-80.

Rail bender, Hydraulic. By G. L. Gillon, 1901, i-*96.

* denotes an illustrated article. † denotes an inset sheet.

Rail joints:

- Barschall. Pennsylvania R. R. tests. 1901, i-*254.
 Bonzano, Manufacture of. By W. R. Webster, 1900, i-78.
 Broken and square joints on double and single track. Opinions of officials of several railway companies. Relative impact of wheels on joints. 1900, ii-331; By F. J. Allen, J. G. Sullivan, E. M. Smith, 1901, ii-280, 331, 368.
 Falk cast-welded joint, European street railway use of. 1900, ii-330.
 Four-bolt and six-bolt joint recommended by American Railway Engineering and Maintenance of Way Association. 1904, i-*264.
 Pittsburg & Lake Erie R. R. New "100 per cent". 4-bolt joint for 80-lb. and 90-lb. rails. Old 6-bolt angle-bar joint. 1902, i-*510.
 Reinforced joint of Scranton, Pa., street railway. 1901, ii-*495.
 Report on, at Roadmasters' and Maintenance of Way Association. 1904, ii-264.
 Short six-bolt joints proposed for Union Pacific Ry., by J. B. Berry. 1900, ii-17.
 Standard joints on railways of United States, Canada and Mexico. 1900, ii-142, 149, 430.
 Step joints on the Illinois Central R. R. and the N. Y. C. & H. R. R. R. Atlas Ry. Supply Co. 1901, i-*35.
 Track bolts, Reversing alternate, in rail joints. 1900, ii-341.
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Rail loading and unloading machines, Notes on. 1903, ii-361.

Rail sections:

- American Society of Civil Engineers:
 Standard section. Revision. Appointment of Committee. 1901, ii-156.
 Standard section. Is this the best rail section for the outside rail of sharp curves? Section on Indian Railways. 1904, i-*329.
 Wear of wheels on sharp-cornered rails. 1900, i-208.
 India. Darjeeling-Himalayan Ry. and Kalka-Simla Ry. Section with flaring sides. 1904, i-*329.
 Mexican Central Ry. 75-lb. rail. 1900, i-*264.
 Microphotographic sections from heads of 85-lb rails rolled by usual process and by Kennedy-Morrison process. 1901, i-*39.
 Report at American Railway Engineering and Maintenance of Way Association. 1902, i-244.
 Rail splice, Defective design, Pitts. & Lake Erie R. R. By E. F. Wendt, L. L. Tallyn, H. V. Hinekley, 1902, i-*70, 90, *155.

Rails:

- Chemical composition of steel rails. By E. F. Kenney, 1901, ii-226.
 Chemical specifications. By R. W. Hunt, 1900, ii-68.
 Corrosion of steel rails by sea water in tropical countries. Sumatra State Ry. Rail section after 10 years' service. By J. W. Post, 1901, ii-*394.
 Creeping rails on Eads bridge, St. Louis. Record of creeping of rails, Nov., 1899, to July, 1900. 1900, ii-163.
 Curved rails. Should they be curved before laying? 1902, ii-221.
 Discussion at American Railway Engineering and Maintenance of Way Association. 1900, i-197; 1901, i-207.
 Earth's rotation, Influence of, on rail wear. By G. W. Colles, 1904, ii-335.
 Expansion of. Circular "The Long Lost Remedy Found". 1900, i-42.
 Foundations. (See Ties; Track, Street railway.)
 Fractures and microstructure of steel rails. Results on Phil. & Read. Ry. By Robert Job, 1903, ii-*66.
 Girder-rail track construction for city streets, Penn. R. R. 1904, ii-*134.
 Highway traffic:
 Contractor's steel wagon way. Greentree tunnel on the Pitts., Carn. & West. R. R. 1903, ii-546.
 Discussion. By M. O. Eldridge, I. O. Baker, 1902, i-182, 365, 459, 504.
 Experimental steel trackway in New York City. 1902, ii-*477; 1904, ii-445.

"1900, ii-112" means "Year. 1900, second volume, page 112."

Rails: (Continued.)

History of the use and the manufacture of iron and steel rails in America. By R. W. Hunt, 1900, ii-66.

Imports of American rails into Japan. 1900, i-233.

Kennedy-Morrison process for finishing rails at a low temperature. Edgar Thomson Steel Works, Pittsburg, Pa. Plant and its operation. Criticism by Albert Sauveur. 1900, ii-437; 1901, i-*38; 1902, i-511.

Manufacture, Suggestions for. Blooming, composition, finishing, segregation and straightening. By E. F. Kenney. 1901, ii-*226.

Microphotographs from rails finished at different temperatures. By E. F. Kenney, 1901, ii-*226.

Nickel steel rails on Penn. R. R., Horse Shoe Curve, near Altoona, Pa. 1900, i-217.

Notes on rail-steel. By R. W. Hunt, 1904, i-232.

Piped rails. "Casting of pipeless ingots by the Sauveur overflow method". 1903, ii-31.

Plate-way track system, Notes on. 1901, ii-81.

Prices:

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Exchanging old rails for new ones at a profit, Chic. Great Western Ry. 1900, ii-157.

Relative prices of light and standard rails. 1904, i-304.

Steel rail prices and freight rates on steel exports. Rails, \$26. 1900, ii-264.

Quality of steel for rails. Discussion at International Railway Congress, Paris, Sept. 1900. 1901, i-173.

Rack rails:

Electric railway between Bex and Villars, Switzerland. 1902, ii-*52.

Strub system of rack rail. Jungfrau Rack Ry., Switzerland. 1900, ii-*254.

Report on rails at American Railway Engineering and Maintenance of Way Association. 1904, i-281, 286.

Sauveur thermomagnetic selector for determining the temperature at which rails are rolled. 1903, ii-33.

Sharp-cornered rails, Wear of wheels on. American Society of Civil Engineers' Section. History and development. Moncrieff's letter from Australia. Letters from various railway engineers. 1900, i-208.

60-foot rails at street crossings, Use of. 1903, ii-362.

Sorbitic steel rails, Experiments in making. By J. E. Stead and A. W. Richards, 1903, ii-261, 268.

Specifications:

American Society for Testing Materials. Discussion of changes. 1902, i-511.

Bessemer steel rails. American Railway Engineering and Maintenance of Way Association. 1904, i-275.

Chemical specifications. By R. W. Hunt, 1900, ii-68.

International Association for Testing Materials. 1901, ii-11.

Report at American Railway Engineering and Maintenance of Way Association, March, 1902. Process of manufacture. Chemical properties. 1902, i-244.

Standard proposed, by American Institute of Mining Engineers. By W. R. Webster, 1901, i-352.

Suggestions for steel rails. By E. F. Kenney, 1901, ii-*226.

Standard rails in United States, Canada and Mexico. Tables. 1900, ii-142, 148, 430.

Standard rails on English railways. 1904, ii-508.

* denotes an illustrated article. † denotes an inset sheet.

Rails: (Continued.)

Steel and iron rails, History of, in America. By R. W. Hunt, 1900, ii-66.
 Steel rails: the relations between structure and durability. Investigation at the Test Department of the Phil. & Read. Ry. By Robert Job, 1902, ii-*2.

Street railways:

Converting step rails to grooved rails by use of cast iron blocks. Inventor of blocks, S. J. Buckland. 1901, i-*381.

Demerbe rail. 1901, ii-*78.

Designs of rail section in Philadelphia, Brooklyn, Boston and New York. Section recommended by B. J. Arnold for Chicago. By B. J. Arnold, 1903, i-*190.

Rails for both steam and electric service. By T. R. H. Daniels, 1903, i-60, 79.

Wear of, in Sheffield, England. Discussed by C. F. Wike. Table. 1902, ii-330.

Stremmatograph tests of fiber strains in rails under moving locomotives. By P. H. Dudley, 1903, ii-127.

Stresses in rails, Fiber, under moving trains. Influence of stiffer rails on the development of the locomotive. By P. H. Dudley, 1901, ii-365.

T-rail, Inventor of. By W. M. Dawley, 1902, i-134, *215.

Temperatures, Finishing, for steel rails. By R. W. Hunt, 1901, i-354.

Unloading rails from work trains. Pneumatic device of Buff., Roch. & Pitts. Ry. 1903, ii-*325.

Welded rails:

Experience with electrically welded street railway track in the United States. By William Pestell, 1903, ii-*239.

Rochester, N. Y. Electric welding. 1902, ii-311.

Railway accidents:

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Hancock, N. Y., Dec. 23, 1903. 1904, i-12.

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Butting collision of locomotives at White Pigeon, Mich., Feb. 23, 1901. 1901, i-201.

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Collisions of work trains. 1903, ii-490.

Curious statistics of English and American railways. Thompson's pamphlet. 1904, i-129.

Denver & Rio Grande R. R. Trestle disaster, Aug. 7, 1904. Report of Coroner's Jury. 1904, ii-134, 197, 201.

Derailments, Car trucks and car wheels as causes of. 1901, i-448.

Derailments and conclusions to be drawn therefrom. By W. H. Elliott, 1901, i-68.

Derailments in Illinois. Signals disobeyed. 1903, i-175, 180.

Erie R. R., Midvale, N. J. Rear-end collision. 1904, ii-44, 74.

Interstate Commerce Commission's Report. Table giving causes of 29 prominent accidents. 1904, i-175, 200; 1904, ii-110, 383, 449.

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Lading of freight cars, Wrecks due to. 1903, ii-590; 1904, i-12.

Lessons on collisions of Central R. R. of N. J. and Southern Pacific R. R. Coroner's verdict. 1903, i-126, 127, 151, 174, 180, 214.

Northern Pacific Ry. Wreck of S-bridge near Mullan, Idaho. 1903, i-*224.

Notable train wrecks. Wrecks of steel cars. Locomotive loaded for shop. Losing car en route. 1901, i-*178.

Oregon Short Line R. R., Cookville, Wyo. By H. A. Storrs, 1904, ii-*200.

Pay of railway employees and accidents. 1904, ii-449.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Railway accidents: (Continued.)

Pere Marquette R. R. Head collision on Dec. 26, 1903. Extinguishing of lamp in train order signal. By W. F. Allen, 1904, i-36, 81.

Rear collisions. Palota, Austria, Sept. 21. Gt. Northern Ry., Aug. 31. 1901, ii-216.

Reports to Interstate Commerce Commission. Bill in Congress. 1901, i-188.

Southern R. R., Danville, Va. Wreck of train Sept. 27, 1903. 1903, ii-304, *321, 340.

Steel cars, Peculiar wrecks of. 1901, ii-*213.

Train order system, Dangers of. Butting collisions on the Grand Trunk Ry. 1903, i-1, 12, 56, 214.

United States. Progress toward safer railway operation. Statistics. 1902, i-502; 1903, i-555; 1903, ii-501.

Railway appraisal:

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Union Pacific Ry. Appraisal. By J. B. Berry, 1904, i-337.

Wisconsin. Appraisement of physical value of railways for the purpose of taxation. By W. D. Taylor, 1904, i-314.

Railway ballast. (See Ballast.)

Railway center line, Re-establishing and monumenting. By A. I. Frye, 1904, i-*351.

Railway consolidation of anthracite railroads. 1901, i-28, 48, 136.

Railway construction, Notes on, from the resident engineer's standpoint. By F. C. French, 1904, i-98.

Railway crossings. (See Grade crossings.)

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Railway employees:

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German school of employees at Munich. 1901, ii-1.

Increase of 10% in wages. 1902, ii-448.

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United States Railway employees. Notes from the Bulletin of the Department of Labor. 1902, i-38.

Railway engineering school at McGill University. 1904, i-128.

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Railway location:

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Poorly located railways. By P. F. Barr, J. L. Campbell, 1900, ii-374, 445; By G. H. Cooke, 1902, i-195, 254, 256.

Problem in railway location. By E. E. Woodman, P. H. Philbrick, C. B. Breed, R. A. Thompson, 1901, i-266, 297.

Stadia measurements in railway location. By H. P. Boardman, 1901, i-133, 153.

Theories upon location. By J. G. G. Kerry, 1903, ii-170.

Victoria, Australia, Light traffic railways in. By D. M. Fraser, 1904, i-448, *458; 1904, ii-154.

Railway maintenance of way:

Graphical record of organization, of construction and maintenance of way department. International Ry., Buffalo. 1902, i-409.

Records of maintenance of way. Rio Grande, Sierra Madre & Pacific Ry. By L. P. Atwood, 1902, i-111.

* denotes an illustrated article. † denotes an inset sheet.

Railway maintenance of way: (Continued.)

Ratio of operating expenses to gross earnings on English and American railways. Should taxes be included with operating expenses in railway accounting? Table giving figures for various American railways and English railways. By Stuyvesant Fish, 1900, i-166, 212, 244.

Reports at meeting of Association, Chicago. Proper organization of such a department. 1900, i-196, 200.

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Railway rates:

Passenger traffic and passenger profits on American railways. 1900, ii-108.

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Trans-Siberian Ry. rates. 1902, ii-73.

Workmen's trains, London, Brighton & South Coast Ry. 1904, ii-114.

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Railway shops. (See Locomotive shops; Locomotive works.)

Railway Signal Association, Convention. 1904, ii-354.

Railway Signaling Club, Convention. 1902, ii-403.

Railway stations:

Boston, South Terminal Station. Waterproofing methods described by Geo. B. Francis. 1900, i-221.

Chicago. New terminal station of C., R. I. & P. Ry. and L. S. & M. S. Ry. 1903, ii-69, *114.

Cincinnati, Ohio. Terminal station and freight-handling system for inter-urban electric railways. 1903, i-*106.

Dayton, Ohio. Union station. 1901, ii-*82.

Fort Dodge & Omaha Ry. Standard designs. 1900, i-†52.

Grand Central Station, New York City. Reconstruction plans. New terminal tracks. 1903, i-12, *44; 1904, ii-*597.

Lafayette, Ind. Chic., Ind. & Louis. Ry. 1903, ii-*119.

Melbourne, Australia. Notes on proposed new station. 1900, ii-53.

Paris, France. Paris & Orleans Ry. terminal improvements. 1904, ii-149.

Philadelphia, Penn. R. R. New station and tracks at Market and 32d streets. 1902, i-*475.

Pittsburg, Pa., Penn. R. R. New union station and general office building. 1900, i-*311.

Platforms, Material and cost of. Reports from various roads. 1901, ii-284.

Richmond, Ind., Cin., Rich. & Muncie R. R. 1902, i-*497.

Richmond, Va., Ches. & Ohio Ry. 1900, ii-†380.

San Antonio, Tex., Southern Pacific Ry. By J. D. Isaacs, 1903, ii-*579.

Springfield, Ill. Ill. Central Ry. 1900, i-†151.

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Railway stories. By L. E. Johnson, 1901, i-339.

Railway tangent, Longest, in the world. 1903, i-183, 393.

Railway terminals:

Boston. Statistics of South Station, 1899-1903. By E. L. Corthell, 1903, ii-442, 505.

Brooklyn Wharf & Warehouse Co. Atlantic and Brooklyn terminals. By E. E. R. Tratman, 1900, ii-377.

Chesapeake & Ohio Ry., Richmond, Va. Details of viaducts and station. 1900, ii-†379.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Railway terminals: (Continued.)**Chicago:**

Central station proposed for Ill. Cent. Ry. and Chic. & Northwestern Ry. 1901, i-385.

Chic., R. I. & Pac. Ry. and Lake Shore & Mich. South. Ry. New terminal station. 1903, ii-69, *114.

Chicago Transfer & Clearing Co. Switching and transfer yards. 1901, i-425.

Cincinnati, Ohio. Terminal station and freight-handling system of inter-urban electric railways. 1903, i-*106.

Design. Terms and definitions. Report of American Railway Engineering and Maintenance of Way Association. 1901, i-197.

Double-deck freight terminal, Manchester, Eng., Gt. Northern Ry. 1900, i-89.

Loop terminals and transfer station of the Metropolitan West Side Elevated R. R. of Chicago. 1902, ii-*115.

N. Y. C. & H. R. R. R., Grand Central Station. Proposed new tracks and elevation of streets. 1903, i-12, *44.

Northwestern Elevated Electric Ry., Chicago. Plan of terminal. By E. E. R. Tratman, 1900, ii-*377.

Reports on yards and terminals at Railway Engineering and Maintenance of Way Association. 1902, i-*279; 1903, i-258.

Requirements of railway terminals. Double-decked and loop terminals. By E. E. R. Tratman, 1900, ii-*376.

St. Louis, Mo.:

Improvements. Report by Business Men's League. 1903, ii-401.

Union station. Rearrangement of tracks and station facilities. 1904, ii-*290.

Wabash R. R., for World's Fair traffic. Terminal and signaling arrangements. 1904, i-*78.

Traffic statistics. By E. L. Corthell, 1903, ii-505.

Washington terminal improvements of the Balt. & Ohio and Penn. Rys. By W. F. Strouse, 1904, ii-*415.

Water and rail terminals. Report at American Railway Engineering and Maintenance of Way Association. 1903, i-258.

(See also Freight houses; Railway stations; Railway yards; Street railway terminals.)

Railway traffic:

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Estimating the volume of traffic. 1904, i-105.

Railway water stations:

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Reports on water supply service, American Railway Engineering and Maintenance of Way Association. 1901, i-196, 214; 1902, i-*249; 1904, i-264.

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Victorian Railways, Australia. Bowl-shaped tank. By A. Groudy, 1903, ii-592.

Railway yards:

Chicago Transfer & Clearing Co. Switching yards. 1901, i-425; 1902, i-8, †12.

"Cluster" or general yards. Report at Railway Engineering and Maintenance of Way Association. 1902, i-*279.

Design of yards. Terms and definitions. Report at American Railway Engineering and Maintenance of Way Association. 1901, i-197.

Gravity sorting yards of the Chicago Transfer & Clearing Co. 1902, i-8, †12.

Reports at American Railway Engineering and Maintenance of Way Association, 1902, i-*279; 1903, i-258.

* denotes an illustrated article. † denotes an inset sheet.

Railway yards: (Continued.)

Requirements of railway yards. By E. E. R. Tratman, 1900, ii-*376.
Track, Setting out. Practice of the N. Y., N. H. & H. R. R. at Boston, Mich. Cent. R. R., Lehigh Valley Ry., Chicago Junction Ry. and the Penn. Lines. 1901, i-*232.

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Railways:

Africa:

Cape Government. Statistics for 1900. 1901, ii-1.

First transcontinental railway. By C. Corner, 1902, ii-426.

Alaska Central, A year's work on. By A. W. Swanitz, 1904, ii-*203.

Anthraccite coal railways, Consolidation of. 1901, i-28, 48, 136.

Argentine-Chile Transandine. 1903, i-397.

Asia Minor. Metal ties being replaced by oak ties. 1903, ii-69.

Atch., Topeka & Santa Fe. San Francisco freight terminal plans. Tie and timber department established. 1902, ii-1; 1904, i-447.

Aurora, Elgin & Chicago. (See Electric railways.)

Australia:

Grade compensation for curvature on South Australian railways.

Experiments with heavy ore trains. By A. B. Moncrieff, 1902, i-*505.

New South Wales. Statistics, 1900-1901. Progress. 1900, ii-221; 1901, i-450; 1901, ii-312; 1902, ii-291; 1903, ii-453.

Trans-Australian project. 1902, i-61.

Victoria, Economic construction of light railways in. By D. M. Fraser, 1904, i-448, *458.

"Automobile railroad." (See Motor vehicles, Road train.)

Balt. & Ohio. Baltimore tunnel, Murphy third rail system. 1901, i-113.

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 "1900, ii-112" means "Year, 1900, second volume, page 112."

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Massachusetts Pipe Line Gas Co. Methods employed in keeping a record of the work of laying a large system of gas mains. By W. W. Cummings, 1902, ii-252, 264.

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"1900, ii-112" means "Year, 1900, second volume, page 112."

Records, reports and accounts, Railway:

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Chic. & Northwestern Ry. Records of real estate. By H. I. Orwig, 1903, i-108.

Method of preparing and preserving real estate records. By Arthur Haviland, 1902, ii-*352.

Report at Railway Engineering and Maintenance of Way Association. 1902, i-283.

Work train records of Rio Grande, Sierra Madre & Pacific Ry. By L. P. Atwood, 1903, i-115.

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Horizontal reinforcement vs. trussed reinforcement. Sheering stress. Tests at Terre Haute, Ind. By Maurice Goldenberg, A. L. Johnson, Julius Kahn, 1904, i-*158, 354, 355, *426.

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Kahn and Johnson systems of reinforced concrete compared. By Julius Kahn, Maurice Goldenberg, A. L. Johnson, 1904, i-*158, *354, *355, *426.

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- Rational formulas for the strength of a beam. By S. E. Slocum, C. C. Hurlbut, W. K. Hatt, 1903, ii-*107, 144, 164.
- Reinforcement against tensile stress. "Skin friction." End stirrups. By W. W. Christie, A. L. Johnson, Edwin Thacher, J. S. Sewell, J. W. Schaub, 1903, i-*112, 151, 256, 278, 348, 568.
- Simple formula for beams. Proposed methods of computing strength. By F. L. Batchelder, W. T. Walker, 1904, i-130, 202, 226.
- Strength of flat plates with an application to concrete-steel floor panels. By S. E. Slocum, 1904, ii-22.

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- Purdue University tests. Methods and results. By W. K. Hatt, 1902, ii-53.
- Talbot, Turneure and Marburg tests. 1904, i-585.
- Test to destruction of a 65-ft. truss bridge span with chords of hooped concrete, by Considère. 1904, i-*430.
- University of Illinois tests to determine deformation, deflection and alteration of neutral axis. By A. N. Talbot, 1904, ii-*122.
- University of Pennsylvania tests of beams. By Edgar Marburg, 1904, ii-216.
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- Theory of the strength of beams of reinforced concrete. By W. K. Hatt, J. O. Ellinger, 1902, i-*170, 194.
- Vertical reinforcement by means of the Kahn bar tests. By Julius Kahn, 1903, ii-*349.
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- Asphalt lining, Action of water upon. Notes on Denver reservoir. 1900, i-188.
- Arch vaulting, Elliptical groined. Data relating to such reservoirs in United States compiled by Leonard Metcalf. 1903, ii-238.
- Attica, Indiana. Covered reservoir. By W. S. Shields, 1900, i-70.
- Aurora, Ill. Concrete-lined reservoir with concave slopes. Abstract of specifications. 1902, i-*423.
- Brookline, Mass. Concrete roof for old reservoir. By F. I. Winslow, 1903, ii-*431.
- Brooklyn, New York. Millburn reservoir. Relining with concrete proposed. 1901, i-17.
- Burlington, Vt. Cleaning the distributing reservoirs. By F. H. Crandall, 1901, ii-463.
- California, Southern. Notes on Sweetwater, Morena, Barrett and Otay dams and reservoirs. By Robert Fletcher, 1901, ii-124.
- Camden, N. J. Break in reservoir embankment, Oct. 2, 1902. 1902, ii-281, *289, 292.
- Canton, Ill. Concrete and brick reservoir. By G. W. Chandler, 1902, i-129.
- Cleaning reservoirs:
- Burlington, Vt. By F. H. Crandall, 1901, ii-463.
- Mason device for cleaning settling reservoirs while in use. 1901, i-*463.
- Spot Pond reservoir, Metropolitan Water Supply. By C. M. Saville, 1901, ii-*442.

"1900, ii-112" means "Year, 1900, second volume, page 112."

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Concrete and expanded metal. Antwerp, Belgium, 1901, i-409.

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Aurora, Ill. Specifications. 1902, i-423.

Forbes Hill, Quincy, Mass. Cost of concrete work. Distribution of cement. By C. M. Saville, 1902, i-*218.

Lining of canal in sandy soil, Kern River power plant. By Burr Bassell, 1904, ii-*57.

Covered reservoirs:

Attica, Indiana. By W. S. Shields, 1900, i-70.

Brookline, Mass. Concrete roof for old reservoir. By F. I. Winslow, 1903, ii-*431.

Delphi, Indiana. By W. S. Shields, 1900, i-70.

Diagram for determining the volume of semi-elliptical groined arch vaulting. By J. H. Gregory, Jr., 1900, ii-130.

Groined arches covering reservoirs and filter beds in the United States. By Leonard Metcalf, 1903, ii-564.

Louisville, Ky. Clear water reservoir of 25,000,000-gallon capacity covered with groined concrete and metal arches. 1901, i-*34.

Pittsford, Vt. 150,000-gallon reservoir. 1900, ii-234.

Superior, Wis. Removal of iron from water supply. By R. D. Chase, 1901, i-*143.

Delphi, Indiana. Covered reservoir. By W. S. Shields, 1900, i-70.

East Liverpool, Ohio. Failure of reservoir, Oct. 13, 1901. 1901, ii-297.

Failures. Classified review of dam and reservoir failures in the United States. By W. R. Hill, 1902, i-506.

Forbes Hill, Quincy, Mass. Construction details. Cost of earthwork and concrete work. By Olaf Helweg, C. M. Saville, 1902, i-†217, 254.

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Grand Rapids, Mich. Bursting of reservoir on July 2, 1900. 1900, ii-*25, 26.

Hope Ranch, near Santa Barbara, Cal. Failure. 1902, ii-73.

Jerome Park, New York:

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Croes, J. J. R., Letter of, to Aqueduct Commissioners and reply by William R. Hill. 1902, i-116.

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Examination of material underlying site of reservoir authorized by Aqueduct Commissioners. 1902, i-101.

Investigations by N. P. Lewis and N. S. Hill, Jr. 1903, i-225.

Report recommending changes by Croes, Smith and Sweet. 1901, ii-410, *455.

Report of Chief Engineer William R. Hill on proposed changes in the dam, submitted Dec. 4, 1901. 1902, i-*44, 50.

Report of Edwin F. Smith on the proposed changes. 1902, i-46, 50.

Report of Commission. 1903, ii-49, 89, 122, 129, 454.

Sweet, Elnathan, Letter of, to Aqueduct Commissioners and the reply by William R. Hill. 1902, i-116.

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Louisville, Ky. Clear water 25,000,000-gallon covered reservoir. Groined concrete and metal arch covering. 1901, i-*34.

Marietta, Ohio. Twin settling reservoirs. 1902, ii-447.

Natick, Mass. Concrete roof. 1903, ii-238.

Philadelphia water filtration system. 1904, ii-*513.

Pittsburg, Pa. Hiland Ave. Construction methods. 1902, i-233.

Pittston, Pa. Failure, Nov. 28, 1901. 1901, ii-417.

* denotes an illustrated article. † denotes an inset sheet.

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- Puget Sound Power Co. 1904, ii-*275.
 Red Wing, Minn. Failure. By F. H. Bass, 1904, ii-508, *527.
 Settling reservoir, Kansas City, Mo. Reinforcement of walls. By W. Kiersted, 1900, i-†3.
 Silt deposits. (See Dams, Austin, Texas; Rivers, Silt-bearing.)
 Spot Pond, Metropolitan Water Supply:
 Cleaning and enlarging the storage reservoir. Cost of day work. By C. M. Saville, 1901, ii-*442.
 Landscape problems. By F. L. Olmstead, Jr., 1900, ii-219.
 Storage reservoirs in Southern California. Notes on Sweetwater, Morena, Barrett and Otay dams and reservoirs. By Robert Fletcher, 1901, ii-124.
 Trenton, N. J. Description of reservoir completed in 1899. By C. A. Hague, 1901, i-*437.
 Troy, N. Y., water-works. Cost of reservoir construction. By W. G. Raymond, 1904, ii-304.
 Utah Lake. Possibilities of the lake as a reservoir. By W. P. Hardesty, 1903, i-*442.
 Utica, N. Y. (See Dams, Utica, N. Y.)
 Wachusett, Mass.:
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 North Dike, Construction of. By F. P. Stearns, 1902, i-*366.
 Winston, N. C. Failure of small brick distributing reservoir built on top of hill. By J. L. Ludlow, 1904, ii-*444.
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 Retaining barriers for the debris from hydraulic mining in the Yuba River, California. 1903, i-*52, 363; 1903, ii-554.
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 Chic., Mil. & St. Paul Ry. Concrete abutment for Chicago track elevation. 1900, i-*123.
 Concrete-steel design patented by F. A. Bone. Bridge at Black Lick, Ohio. Patent by J. Lehman disputes Bone's patent. 1902, i-*242; By J. Lehman, David Molitor, 1902, ii-*97, 170.
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 Design of retaining walls. Condition of walls in the city of Quebec. By Charles Baillairge, 1901, i-96, 100.
 Hennebique system of concrete and metal. Temporary sunken street at Paris Exposition of 1900. 1900, i-*111.
 Ithaca, N. Y. Concrete walls with buttresses. 1904, ii-*109.
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 Ulster & Delaware R. R. Concrete bridge abutment and parapet wall for a skew bridge. 1903, ii-*270.
 Wabash R. R. Concrete-steel bridge abutment. 1904, ii-*62, *432.
 Washington, D. C., terminal improvements of the Balt. & Ohio and Penn. railways. By W. F. Strouse, 1904, ii-*418.
 Welland canal basin, Port Colborne, Ontario. Concrete walls. 1902, i-*384. (See also Slope-walls.)
 "Revealers" for studying condensation in steam engine cylinders. Results of tests. By Bryan Donkin, 1900, ii-*318.
 Revetment work on the Missouri River, Chicago & Alton Ry. Estimated cost. By W. R. DeWitt, 1902, i-*450.
 Reynolds, Edwin, Biographical sketch of. 1902, i-†43.
 "1900, ii—112" means "Year, 1900, second volume, page 112."

Rifle-ranges, Canadian practice in laying out. 1901, i-*119.

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River gagings:

American practice in stream measurement. By F. C. Shenehon, 1904, ii-365.

Mean velocity of a cross-section, Methods of obtaining. By C. H. Miller, R. W. Pratt, H. F. Robinson, 1904, i-258, 307.

Method of computing daily and monthly discharge of streams with sandy, changeable bed. By E. C. Murphy, 1904, i-379.

Methods of the United States Geological Survey. Results of velocity determinations made for the Susquehanna River at Harrisburg. By J. C. Hoyt, 1904, i-47.

New England river gagings. United States Geological Survey. 1904, i-423.

Notes on the computation of stream gagings. Harlacher method. Volume method. By O. V. P. Stout, 1904, ii-*521, 547.

Relation of surface to mean velocities of stream flow. Investigation by J. B. Lippincott and others in the West. 1902, i-424.

Russian experiments by Leliavsky. 1904, ii-183, 242.

Southeastern states. Data in regard to low water period. By M. R. Hall, 1904, ii-487.

Susquehanna River near McCall's Ferry, Pa. Cable gaging station. By R. H. Anderson and J. C. Hoyt, 1904, ii-103, *104.

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River piers. (See Docks.)

Rivers:

Alaska, Talbiksak River in. A possible shortening of the Yukon route. By W. S. Post, 1901, ii-128.

Argentine rivers Parana, Uruguay and Rio de la Plata. Details of the great river system. By E. L. Corthell, 1904, i-7.

Chicago:

By pass channel opened April 6, 1900. 1900, i-265.

Effect of Drainage Canal on flow of river. 1900, i-85, 121, 137, 427.

Expert commission's plans for increasing flow through Chicago drainage canal. Detailed estimates of cost. Commission discharged. 1901, i-245, 345.

Improvements in relation to navigation and in connection with Chicago drainage canal. Address by L. E. Cooley. 1901, i-41.

Narrowness causes accident to large steamer. 1902, ii-205.

Progress of improvements. 1903, ii-89.

Report on improvements by Isham Randolph to engineering committee of Sanitary District. 1901, i-465.

Widening of river from Lake Street to Van Buren Street. 1902, i-35.

Colorado. Measurements of the flow of rivers made by L. G. Carpenter. 1903, ii-1.

Deflections of currents. Experiments in Russia by Leliavsky. 1904, ii-183.

Delaware. Channel improvements. Methods of measuring dredged channels. 1901, ii-249, 321; 1902, ii-*8.

Discharge of. (See Hydraulic formulas; River gagings.)

Dnieper, Russia. Proposed improvements. 1900, ii-69.

Dowagiac, Mich. Improvement of river for drainage purposes. 1902, i-48.

Erosion of river bends. Improvement of Southwest Pass of Mississippi River. By L. M. Haupt, H. P. Gillette, 1900, ii-*250, *282.

Flow and storage in relation to irrigation. By Elwood Mead, 1903, i-556.

French River, Canada. Improvement schemes. 1900, i-86.

* denotes an illustrated article. † denotes an inset sheet.

Rivers: (Continued.)

- Ice-jams, Allowance for, in estimating flood-height of streams. 1904, i-400.
- James River, Va. Physical and bacteriological characteristics, with special reference to classification methods. 1900, i-351.
- Mississippi:
- Bank revetment. Construction of fascine mattresses. By Charles Le Vasseur, 1901, ii-*322.
 - Crevasse, Closing of, in a Louisiana levee. 1903, i-419, 454.
 - Drainage of inner basins of levee system. By Charles Le Vasseur, 1904, ii-*372.
 - Floods, Increasing height of, in the lower river; the problem and its solution. History of floods. By L. W. Brown, W. J. Hardee, 1901, i-280, 284, 378.
 - Floods and the levee system. Criticism by the "New York Times." Sources of funds for levee construction. Major Harrod quoted. St. Louis "Globe-Democrat" on the levee system. 1903, i-245, 276, 346, 408; By T. G. Dabney, 1903, ii-12, 27.
 - Improvement of the lower river. By J. A. Ockerson, 1901, ii-186.
 - Levee system. Vindication of levee engineers. Resolutions adopted by the Levee Association in convention at New Orleans, Oct., 1903. 1903, ii-432, 435.
 - Protection of cities in the Mississippi Valley against the encroachment of the river. By L. W. Brown, 1901, i-427.
 - Relation of snow to the June rises. By W. D. Taylor, 1904, i-179.
 - Reservoir system proposed for the control of the lower Mississippi. By J. A. Seddon, 1900, ii-*293, 296.
 - St. Francis levee districts of Arkansas and Missouri. By H. N. Pharr, 1902, i-24, 28.
 - South Pass improvements. By William Starling, 1900, ii-*121, 128.
 - Southwest Pass improvements. 1900, i-49, 117; By L. M. Haupt, H. P. Gillette, 1900, ii-*222, *250, *282.
 - Missouri. Revetment work by the Chicago & Alton Ry. By W. R. DeWitt, 1902, i-*450.
- Passaic, N. J.:
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 - Water pollution. (See Water pollution, Passaic River, N. J.)
- Pollution of rivers. (See Water pollution.)
- Regulation of, as a matter of flood protection. 1904, i-256.
- St. Lawrence:
- Dangers of the St. Lawrence route for export traffic. By A. C. D. Blanchard, 1902, ii-249, 315.
 - Ship canal, Progress of. 1904, ii-82.
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- Silt-bearing streams and construction of dams. By T. U. Taylor, 1900, i-128, *135, 161, 179, 212, 410; By E. G. Harris, 1901, ii-*110.
- Silt investigations. Average percentage of silt to total volume of flow in certain streams. Water sample trap for silt investigations. 1902, ii-*208.
- Susquehanna:
- Flood discharges. Methods of estimating stream flow. Cable gaging station. By R. H. Anderson and J. C. Hoyt. 1904, ii-103, *104.
 - Velocity determinations made at Harrisburg, by United States Geological Survey. By J. C. Hoyt, 1904, i-47.
- Yazoo. Improvements proposed. 1900, ii-17.
- Yukon, Alaska. Survey of mouths by United States Government. By G. R. Putnam and R. L. Faris, 1900, i-*370.
- Rivet holes in structural work. Drilling instead of punching and reaming. By J. W. Schaub, 1900, ii-255, 372.
- Rivet-spacing machine, Conley. 1904, i-*117.
- "1900, ii—112" means "Year, 1900, second volume, page 112."

Riveted joints:

- Diagram for efficiencies. By G. S. Walker, 1904, i-*116.
 Eccentric loading. By J. L. Hall, Henry Szlapka, 1903, ii-80, 123.
 Polar moment of inertia and its graphical application to. By C. F. Blake and R. W. Runge, 1903, i-*461.
 Riveted connections in torsion. By W. E. Belcher, 1903, i-573.
 Stresses in riveted joints.. By W. H. Boughton, J. L. Hall, 1904, i-*542, 565, 613, *614.
 Table for pitch and efficiency. By P. B. Hill, 1903, ii-68.

Riveters, Pneumatic:

- Hammer riveter with power grip, for boiler work. Allen Pneumatic Machine Works. 1901, i-*461.
 Keystone Bridge Works. Field riveting outfit. 1900, ii-*396.
 Missouri, Kansas & Texas Ry., Southern Pacific Ry. and Illinois Central R. R. Details of riveting outfits for field work. 1900, ii-269.

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- Driving large rivets through keel of 7-masted schooner. 1902, ii-105.
 Experience in field riveting. By F. T. Darrow, 1904, ii-199.
 Hand vs. air-riveting for railway bridge field work. Actual cost compared for the erection of new work and repairing in the field. Report at Association of Railway Superintendents of Bridges and Buildings. 1900, ii-269.
 Riveting traveler on the Boston Elevated Ry. By C. E. Fowler, 1900, i-*180.
 Scranton, Pa., street railway plant for riveting rail joints. 1901, ii-*496.

Rivets:

- Driven, Irregularities in. By G. S. Walker, 1904, i-*117.
 Imperfections in rivet work. By C. J. Tilden, 1903, ii-*110.
 Spacing of rivets. Diagrams for determining minimum alternate spacing of rivets for three diameters center to center. By F. L. Batchelder, A. R. Eldridge, 1901, ii-331, 430; 1902, i-30.
 Stress on rivets. What intensity of stress is allowable? Failure of riveting in plate-girder flanges. By G. A. Glascott, I. P. Snow, 1904, ii-92, 133.

Roadbed. (See Track, Roadbed.)

- Roadmaster's and Maintenance of Way Association. Conventions. 1901, ii-279; 1902, ii-220, 223; 1903, ii-361; 1904, ii-263.

Roadmasters' Association of America. Convention. 1900, ii-341.

- Road material, Testing, in the United States Laboratory for Testing Road Material. 1903, ii-31.

Road rollers:

- Horse and steam road roller work compared by Arthur Hay, Springfield, Ill. Costs. 1902, ii-436.
 Steam roller with vertical boiler. "Universal" roller manufactured by Julian Scholl & Co. Use of a scarifier to break up macadam surface. 1903, i-*154.

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- Albion, N. Y. Lessons from the macadam pavements. By H. P. Gillette, 1901, ii-197, 205.
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 Bicycle paths at Babylon, L. I. and at Minneapolis, Minn. 1901, i-212; 1902, ii-436.
 Bill for a state engineer and state aid for roads. Presented at International Good Roads Convention, St. Louis, May, 1904. 1904, i-494.
 Brownlow-Latimer road bill. 1904, i-496.
 Cementation of road materials and plasticity of clays. By A. S. Cushman, 1903, i-39, 103.
 Cementing power of road materials. By L. W. Page and A. S. Cushman, 1904, ii-441.
 Cementing value of rock powders, Cause of. By A. S. Cushman, 1903, ii-131.

* denotes an illustrated article. † denotes an inset sheet.

Roads: (Continued.)

- Chert road, Cairo, Ill. 1901, ii-394.
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- Connecticut. Wide distribution of State aid. 1901, i-321.
- Convict labor on roads in Southern States. By J. A. Holmes, 1902, ii-432.
- Cost of haulage by horses and the saving effected by road improvement.
By H. P. Gillette, 1901, i-433.
- Cost of maintenance in England. 1904, ii-593.
- Cost of road building. Statistics desired by Director of Office of Public Roads Inquiries, Washington. 1904, i-399.
- Cost of wagon transportation and of the maintenance of earth roads. Discussion by I. O. Baker. 1901, i-86.
- Design of economic streets and pavements. By H. P. Gillette, 1901, ii-165.
- Dirt roads and road organization, Ontario, Canada. By A. W. Campbell, 1904, i-495.
- Earth roads:
- Construction and maintenance in Illinois. By I. O. Baker, F. Hodgman, 1901, i-291, 321.
 - Cost of maintenance and the cost of wagon transportation. 1901, i-86.
 - Gravel roads in the South. Economical methods. By C. H. Scott, 1902, i-*260.
 - Gravel roads of McLean County, Illinois. By A. H. Bell, 1901, i-97.
 - Gravels, Study of various. Requisites for road gravel. Sieve analyses. Mineralogical analyses. By I. O. Baker, 1902, ii-345.
 - Richmond County, Ga., and Shelby County, Tenn. Convict labor and road building. By J. A. Holmes, 1902, ii-433.
 - Saturation of soil in roadbed when frost comes out of the ground. Reasons. By H. P. Gillette, I. O. Baker, 1901, i-322, 358.
 - "Treatise" by A. J. Sager, a copy of I. O. Baker's work. 1902, ii-450, 524.
- Fallacies in good-road economics. Statistical cost of wagon transportation. Reply to the criticisms of the Road Inquiry Bureau's statistics. By I. O. Baker, J. W. Jenks, 1900, ii-322, 332, 373; By Arthur Kirk, Martin Dodge, E. R. Smith, 1901, i-48, 50, 82, 153.
- Government educational and experimental work. 1904, i-495.
- Illinois:
- Construction and care of earth roads. By I. O. Baker, F. Hodgman, 1901, i-291, 321.
 - Costs. 1904, i-86, 110.
 - Good roads problem needs the help of Illinois engineers. By I. O. Baker, 1904, i-161.
- India, Road administration in. By J. F. Pope, 1900, ii-441.
- Investigation by Department of Agriculture. Statistical cost of wagon transportation. By I. O. Baker, J. W. Jenks, 1900, ii-323, 332, 373.
- Jackson County, Mo. Macadam roads built with proceeds of liquor licenses. 1902, ii-73.
- Macadam:
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 - Adjustment of macadam road design to various subgrade soils. 1902, ii-171.
 - Albion, N. Y. Construction, costs and repairing. By H. P. Gillette, 1901, ii-197, 205.
 - Binding of sand by stone dust. By H. P. Gillette, 1902, i-403.
 - "Bitulithic" road proposed, Salem County, N. J. 1903, ii-*279.
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 - Extent of, in the United States. 1902, ii-312, 499.
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 - Proposed pavement in New York City. 1903, i-337.
 - Cambridge shore of Charles River, Mass. Thin macadam construction. By J. A. Holmes, 1904, i-*32, 36.
- "1900, ii-112" means "Year, 1900, second volume, page 112."

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Port Huron, Mich., and Hudson, New York. By H. K. Bishop. H. P. Gillette, F. F. Rogers, 1902, i-*190, 214, 312, 393.

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Small towns, Roads in. 1902, ii-312.

Wyoming, Ohio, and Hudson, New York. By H. K. Bishop, 1902, i-1, 30.

Crowns for macadamized streets. By H. K. Bishop, 1902, i-194.

Cuba. Santiago to Caney. By E. J. Chibas, 1903, i-*551.

Dust on. Tar on roads tried abroad. Sprinkling roads with oil tried in Massachusetts. 1902, ii-281, 312.

Economic value of paved roads in farming districts. By H. P. Gillette, I. O. Baker, 1901, i-266, 305, 307, 337.

Foundations. Gravel used as sub-foundation, cheaper than telford bottoming. 1902, ii-312.

General discussion. Deep and shallow ditches, embankments, cost of earthwork, traction and tractive power. By H. P. Gillette, 1901, ii-*50.

Hudson, N. Y. 6-inch macadam streets. Costs. By H. K. Bishop, 1903, ii-*305, 316.

Hydraulicking macadam in California. 1903, i-397.

Massachusetts. Lowering cost of construction. 1904, i-329.

New Jersey. Methods of construction. 1903, ii-182.

North Carolina, Mecklenburg County. Convict labor. By J. A. Holmes, 1902, ii-433.

Porto Rico. Bidding prices. 1903, ii-Cons. News Sup. Aug. 6, 13, Sept. 10.

Repairing. Is the continuous repair system the most economical? Cost of resurfacing macadam road over a mile long. By H. P. Gillette, 1901, i-411, 417.

Resurfacing. Costs. 1902, ii-312.

Rolling subgrades. 1903, ii-Cons. News Sup., Oct. 8.

Shrinkage under the roller. Experience at Newton, Mass. Experiments on Cambridge shore of Charles River. H. K. Barrows, J. A. Holmes, 1904, i-*32, 36, 131.

Specifications. By H. P. Gillette, A. I. Frye, 1901, ii-351, 390; By Ernest McCullough, 1903, i-189; 1903, ii-Cons. News Sup., Oct. 29; 1904, ii-241.

Tar surface, Westfield, N. J. 1903, ii-352.

Using the run of the crusher for macadamizing. By William Haelig, H. P. Gillette, 1902, i-371, 436, 481, 521.

Macadam vs. concrete, Relative economy of. By S. Whinery, 1904, ii-56, 72.

Massachusetts. Reports of State Highway Commission. 1901, i-194; 1902, ii-312.

Michigan. Construction of earth roads. By F. Hodgman, 1901, i-321.

Minneapolis, Minn. Bicycle paths. Construction costs. 1902, ii-436.

National appropriations for good roads. "Good roads" convention at Chicago, Nov., 1900. 1900, ii-372, 375, 446.

* denotes an illustrated article. † denotes an inset sheet.

Roads: (Continued.)

New Jersey:

County engineers, Work of, on road construction. By James Owen, 1903, i-106.

Improvement act passed by Legislature. 1903, i-357.

State highway construction in 1900. 1901, i-261,

New York:

Building stone roads with borrowed money not advisable. 1902, i-152.

Mileage and costs of improved highways. 1904, i-48.

Notes from report of State Engineer. Survey, design and construction of roads under Higbie-Armstrong law of 1898. Improvement of dirt roads. 1901, i-22, 28.

Work of the New York Highway Commission. 1902, ii-311.

Nova Scotia, Notes on road making in. 1903, i-357.

Oil, Use of mineral, in road improvement. Composition of oils, methods of application, etc. By J. W. Abbott, 1903, ii-190, 248.

Oil for laying dust. Experience in California. By H. M. Chittenden, 1903, i-378.

Oil sprinkled on macadam roads. Massachusetts experience. 1902, ii-312.

Pawtucket, R. I. Bituminous macadam on a 12% grade. 1902, ii-312.

Pennsylvania, Proposed road law. By Arthur Kirk, 1901, i-153, 190.

Porto Rico. Road building under United States military administration.

Standard plans for main and country roads. 1901, i-+202.

Recording graphically inequalities in road surface. Instrument called viagraph. 1900, i-*271.

Records of traffic. Blank forms prepared by Office of Road Inquiries. 1901, ii-8.

Sand-clay roads in the South. Convict labor. 1902, ii-433; 1904, ii-26.

Steel wheelways. (See Rails, Highway traffic.)

Stone roads in Northern Illinois. 1904, i-87.

Tar for laying dust on macadam roads tried abroad. 1902, ii-281.

Tar on macadam roads. 1904, ii-488.

Texas, Improvements in Bexar County. 1904, ii-107.

Traction on wagon roads. Experiments on different roads and pavements. By I. O. Baker, 1902, i-*182, 365.

Wear of roads by automobiles. 1903, ii-412.

Wide tires and better roads at less cost. By J. M. Heiskell, 1901, ii-9.

Wisconsin. Dr. Buckley's report on highway construction. 1903, ii-Eng. Lit. Sup., July 16.

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Robert, Henry M., Promotion of, to position of Chief of Engineers, United States Army. 1901, i-305.

Rock and harpán, Difference between. 1904, ii-424.

Rock powders. Cause of cementing value of. By A. S. Cushman, 1903, ii-131.

Rockslide at Frank, Alberta, April 29, 1903. Official investigation by the Geological Survey of Canada. By William Pearce, 1903, i-397, *490, *492.

Roll-relieving device for plate rolling mills, invented by C. L. Hutson. 1900, ii-205.

Roller bearings:

Footbridge over River Spree, Berlin. 1900, i-*386.

80-ton roller thrust bearing. 1900, ii-*193.

Roller pressure for very great loads. Experiments in designing supports for disappearing guns. By Anthony Victorin, 1901, ii-459.

Rolling mills:

Directly driven by electric motors. Bethlen-Falva Iron & Steel Works, Upper Silesia, Germany. 1904, i-34.

Power consumption. Measuring power required for sheet rolling mills.

Tests at the Jessop Steel Co. By H. G. Manning, 1903, i-*376.

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"1900, ii—112" means "Year, 1900, second volume, page 112."

Rolling structural steel shapes, Grey process. 1901, ii-*387.

Roofs:

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Collapse of a vault roof of Boston City Hall. 1901, ii-281.

Concrete-steel roof of locomotive roundhouse. Long Island R. R. at Morris Park. 1903, i-*363.

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Fink trusses:

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Diagrams for determining weights of riveted steel trusses. By H. G. Tyrrell, 1900, i-*409.

Groined arch roof, Development of, in engineering structures in United States. By Leonard Metcalf, 1903, ii-564.

Hip and valley. Graphical determination of angles. By C. A. P. Turner, 1900, i-†126, 146; By C. G. Wrentmore, 1904, i-28, 161.

Skew connection details, Designing of. By C. A. P. Turner, 1900, i-†107, †127, 146.

Skylight construction, Investigation of. 1904, i-370, 376.

Timber trusses:

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Fire effects. Ivanhoe Paper Mill, Paterson, N. J. By W. W. Christie, 1901, i-*123.

Trainshed roof of Chicago terminal station. 1903, ii-*116.

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Rope:

Determining size of hoisting wire rope. By E. B. Durham, 1902, ii-318, 450.

Manila rope, Working loads for. Experience of the Chic., Mil. & St. Paul Ry. Tests at the Brooklyn Navy Yard. Experience at Massachusetts Institute of Technology. By C. W. Hunt, 1901, ii-444.

Tests on wire made at Washington Navy Yard, 1876-1879. By E. B. Durham, 1902, ii-450.

Winding ropes, Testing, in the province of Anhalt, Germany. By F. H. Probert, 1901, i-125.

Wire ropes and sheaves for passenger elevators. Rules for working loads. Experience in Washington, D. C. Rapid wear of rope subjected to reversed stresses. By H. C. Newcomer, 1903, i-50, 57; By G. M. Campbell, 1903, i-*152.

Rope haulage, Cost of, in English coal mines. 1902, ii-386.

Roundhouses:

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Chicago & Northwestern Ry., Clinton, Ia. 1900, ii-69; 1901, i-*114.

Chic., R. I. and Pac. Ry., East Moline, Ill. 1904, i-*142.

Comparison of circular and rectangular roundhouses. By G. P. Nichols, 1904, i-201, *209.

Construction and equipment of modern roundhouses. 1901, i-474, *479; 1901, ii-120; 1902, ii-*116.

Pits in roundhouses. Chic. & East. Ill. R. R. Pit with convex bottom. 1902, ii-*355.

Roof construction, Reinforced. By S. S. Berquist, 1901, i-137; 1904, i-*363.

Smokejack, Swinging. Illinois Malleable Iron Co. 1900, ii-*287.

Rudder boom, Description of. By H. P. Gillette, 1902, i-*473.

Run-off. (See Drainage areas.)

Rural engineering. 1903, ii-570.

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St. Clair Flats, Mich., Survey of, by J. B. Davis of the University of Michigan. 1902, i-49.

St. Louis, Mo. Exposure of municipal corruption by Circuit Attorney Folk. 1902, ii-424.

Salt mines of Grand Cote Island, Louisiana. Shaft sinking in developing the mines. By J. N. Hazlehurst, 1901, ii-*342.

Sampling machine for sampling pig iron. By P. W. Shimer, 1900, ii-*211.

Sand:

Analyses of molding sand. Effect of certain elements in sand. 1902, ii-186.

Fineness, Method of determining degree of. 1902, ii-186.

Movement of sand on beaches. Observations of Capt. T. H. Rees, at Brunswick Bar, Ga., and tests by J. H. Bacon, at Fernandina, Florida. Movement at Cumberland Sound, as determined from surveys. 1903, i-78, 117; By J. H. Bacon, 1903, i-242.

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Specifications for molding sand. J. I. Case Threshing Machine Co. 1902, ii-185.

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Sand drifts on a Southern Texas railway. By Samuel Young, 1904, i-378.

Sand ejector in connection with the Pittsburg purification works. 1902, i-*138.

Sand elevating wheel, of Calumet & Hecla Mining Co. 1901, ii-*396.

Sand elevator for small foundry at Worthington hydraulic works. 1903, ii-*585.

Sand jacks. (See Jacks.)

Sandstone, Artificial, Manufacture and properties of. By S. V. Peppel, 1903, i-70, 78.

Sand track, Derails and, on inside tracks at crossings. 1902, i-214.

Sand washer for filter plant at Yonkers, N. Y., designed by Allen Hazen. By F. H. Stephenson, 1904, ii-*28.

Sanitary engineering course in engineering schools for municipal health officers. 1901, ii-8.

Sanitary regulations for workmen's camps on Chicago Drainage Canal. 1904, ii-443.

Sanitary science, Principles of. Review of W. T. Sedgwick's book. 1902, i-519, 521.

Sanitary work after flood at Galveston, Texas. Report made to New York Chamber of Commerce. By G. A. Soper, 1901, i-301.

Sanitation and progress. By Walter Wyman, 1901, i-136, 138.

Sanitation of contractors' camps. By A. T. Parsons, 1904, i-590.

Sault Ste. Marie, Engineering and industrial enterprises at. 1902, i-*18, 175.

Saw-bench, Oliver Universal, for pattern shops. American Machinery Co. 1901, i-*412.

Sawdust, Utilization of. 1901, i-177.

Saws:

Defective. Microstructure of steel in circular saw. Microphotographs. By J. A. Aupperle, 1901, i-*162.

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Saws: (Continued.)

Diamond circular saw for cutting stone. George Anderson & Co., Carnoustie, Scotland, 1900, ii-69.

Scales, Automatic weighing hopper, Richardson. 1903, i-*42.

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Six-masted schooners:

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Quincy, Mass., Plans for building. 1902, ii-121, 532.

"William L. Douglas" launched at Quincy, Mass. 1903, ii-193.

Scott, Charles Felton, Biographical sketch of. 1903, i-†91.

Scows:

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Derrick scow with sweep used with diver. Delaware River improvements. 1902, ii-*8.

Measuring load of a vessel by gaging the draft. By L. E. Lion, Carl Bannister, Emile Low, 1902, ii-338, 382, 402, 426.

Moving bridge over the Seine at Passy, Paris. By Rene Bonnin, 1904, i-*161.

Self-dumping decked garbage and refuse scow, Havana, Cuba. By T. W. Allen, 1902, i-*244.

Sounding scow, Catamaran, Buffalo, N. Y., breakwater work. 1901, i-*348.

Steam derrick scow used on construction of Kinnickinnic River draw-bridge, Chicago & Northwestern Ry. 1901, ii-*84.

"Walking" scow for submarine pipe laying. By J. De Galleford, 1903, ii-*569.

Scrap at locomotive and car shops. Economical assortment and disposition of. Chicago & Eastern Illinois R. R. By T. A. Lawes, 1902, ii-217.

Scrapers:

Cable power scraper for earth excavation at Lewis & Clark Exposition grounds. By C. G. Newton, 1904, ii-*349.

Cableway scraper and chute for removing gravel bank. By C. R. Coutlee, 1903, i-*292, 300.

Four-wheeled scraper suggested for the economic handling of earth excavation. By J. H. Lane, 1904, ii-447.

Stubbs wheeled scraper. 1903, ii-*517.

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Scraping tool for dressing stone, James N. Hatch, inventor. 1901, i-*193, 231.

Screens:

Balanced shaking screen. Beatty Fire Clay Co. 1900, ii-*169.

Flume screen for removing twigs, Redlands, Cal., power plant. By E. Duryee, 1903, i-*133.

Gate house screens and screen lifters, Metropolitan Water-Works. By C. W. Sherman, 1900, ii-*218.

Screw-cutting with Pratt & Whitney thread-milling machine. 1903, i-*21.

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Screws, Standard threads for coach and lag. 1904, i-327.

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Sea level, Variations in. 1903, ii-520.

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* denotes an illustrated article. † denotes an inset sheet.

Searchlights. (See Locomotive headlights.)

Seattle, Washington, Notes by an engineer. 1900, i-327.

Second-foot and feet per second. By H. M. Wilson, 1903, i-236.

Section foremen. (See Railway maintenance, Section foremen.)

Section liner, Convenient. By A. S. Burgess, 1901, ii-*25.

Sedimentation basins. (See Water purification, Subsidence.)

Segment, Approximate formulas for finding area of a circular. By W. F. Martin, J. K. Wilkes, 1902, i-113, 154.

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Selling-price, Diagram showing the composition of. By Charles Day, 1903, i-43.

Separators:

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Grease separator for exhaust steam. Toledo Heating & Lighting Co. By H. T. Yaryan, 1900, i-*322.

Separators in Portland cement works. Reasons why they are not used. By E. C. Eckel, 1904, i-344.

(See also Oil separators; Steam separator.)

Septic tanks and settling basins. (See Sewage purification.)

Sewage analyses:

Brockton, Mass. Chemical analyses during 1899. 1900, i-213.

Fond du Lac, Wis. Crude sewage and effluents from septic tanks and contact filter beds. By G. S. Pierson, 1902, i-412.

Hopedale, Mass., Draper Co., Oct., 1900, to Mar., 1901. By Leonard Metcalf, 1901, i-299.

Leicester, Mass. Chemical analyses before and after purification. 1900, i-232.

Madison, Wis., Brockton, South Framingham, Gardner and Marlboro, Mass. 1900, ii-253.

Shelby, Ohio. Chemical analyses. By B. H. Flynn, 1902, ii-435.

Sewage disposal:

American problems, Discussion of. Bacterial treatment of London sewage. 1901, i-65.

Connecticut. Notes on stream pollution, sewerage and sewage disposal in various towns. By F. L. Ford and J. F. Jackson, 1901, i-51.

Country residences. Septic tank plant designed by John W. Alvord, Chicago. 1903, ii-*19.

England. Royal Commission and its reports. 1901, ii-104, 111; 1902, ii-296. (See also Water pollution, England.)

New Jersey. State sewerage commissions and state boards of health, Work of. 1901, i-229; 1903, ii-12.

New York State. Commission proposed by bill in Legislature. 1904, i-80. Passaic Valley, N. J.:

Report of New Jersey State Sewerage Commission. 1900, i-30.

Report of experts to commission. 1902, i-1, 39, 265, 285.

Criticisms of Brooklyn "Eagle." 1902, ii-191.

Report of Commission. 1903, i-89.

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Criticism of a New York City official's attitude, by the London "Surveyor." 1904, ii-197.

Trunk sewer legislation. Legal decision. 1904, ii-94.

Profit, Seeking to make, from sewage, is like trying to "extract sunshine from cucumbers." 1904, ii-197.

Seaside towns. By A. J. Martin, 1904, ii-165, 179.

Source of revenue. Primary and secondary considerations. Editorial of the Boston "Transcript." 1902, ii-192, 214, 238.

Sewage effluents from coarse filters, Stability of. By H. W. Clark, 1902, ii-445, 449.

Sewage experiment station of Massachusetts Institute of Technology, Work of. 1904, ii-350, 386.

Sewage farms:

Berlin, Germany. Operation for 1898-1899. By Allen Hazen, 1900, i-348.

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England, Reading farm, Sandhurst Military Schools sewage farms and Aldershot Camp farm. 1904, i-385.

Paris. Notes. 1903, i-537.

Sewage filter beds, Cost of cinders for. By Ernest McCullough, 1904, ii-136, 151.

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Sewage pumping:

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Fond du Lac, Wis. Electric plant. By G. S. Pierson, 1902, i-*410.

Sewage purification:

Bacterial contact beds, Management of. By G. J. Fowler, 1901, ii-193, 196;

By J. W. Alvord, 1902, ii-448, 460; By Scott-Moncrieff, 1903, i-474.

(See also under Sewage purification, Depew, N. Y.; England; Exeter; Huddersfield; Leeds; Manchester.)

Bacteriology of crude sewage and sewage effluents and standards for potable and non-potable streams. Report made to Royal Commission. By A. C. Houston, 1902, ii-297.

Berlin, Germany. Broad irrigation. Operation of sewage farms for 1898-1899. By Allen Hazen, 1900, i-348.

Birmingham, Ala. and other cities and towns in Jefferson County. Proposed scheme. 1900, ii-345.

Brentwood, N. H. Glover septic tank and filter bed claims. By A. W. Dudley, J. N. McClintock, 1901, i-137, 230.

Brewery wastes. 1904, ii-244.

Broad irrigation:

Healthfulness of milk from dairies on English sewage farms. Aldershot Camp Sewage Farm. Report by F. W. Andrews. 1900, ii-116.

(See also under Sewage purification, Berlin; Guadalajara; Los Angeles; Manchester; Melbourne; Victoria.)

Brockton, Mass.:

Intermittent filtration. Operation of beds in 1899. Analyses, gagings, temperatures, rainfall, cost of labor. 1900, i-213.

Intermittent filtration during 1901. 1902, i-313.

Sludge disposal. Experiments with septic tank. 1900, ii-198.

Cassel, Germany. Sludge reduction and grease extraction plant. Process described by J. Garfield, of Bradford, England. 1903, i-*54.

Chemical precipitation. (See below, Madison, Wis.; Salford, England.)

Clayton, Mo. Septic tank and contact beds for court house sewage. 1902, ii-121.

Columbus, Ohio:

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Plans approved by State Board of Health. Conditions and recommendations. Plans defeated at election. 1901, ii-33, 97.

Testing station. By J. H. Gregory, 1904, ii-*359.

Concord, Mass. Difficulties encountered in building sewage storage well. By Leonard Metcalf, 1900, i-*422.

Connecticut:

Report of State Commission. 1901, i-229.

Third report of Connecticut Sewerage Commission. By L. P. Kinnicut, H. P. Eddy, 1902, i-445.

Fourth report of Sewerage Commission. Results for 1902. 1903, i-311.

Commission ceased to exist June 1, 1903. 1903, i-537.

State Sewerage Commissions and State Boards of Health. 1903, ii-12.

Continuous filters. (See below, Intermittent filtration.)

Cornell University. Experiments on septic tank action. Study on the effects of the various rest periods. By R. B. Williams, Jr., 1901, i-*435.

Crops at Berlin, Germany. Operation of sewage farms. 1898-1899. By Allen Hazen, 1900, i-348.

* denotes an illustrated article. † denotes an inset sheet.

Sewage purification: (Continued.)

- Danville, Ky. Septic tanks. By J. W. Alvord, 1902, ii-460.
 Darwin, England. Proposed changes in disposal works. 1904, ii-122.
 De Kalb, Ill. Septic tank. By J. A. Alvord, 1902, ii-460.
 Depew, N. Y. Septic tank, coke primary filters or contact beds and stone secondary filters on the wave-bed plan. By G. E. Hill, 1902, i-*514.
 Eastern Indiana Hospital for the Insane. Septic tank and filter bed. 1904, i-58.
 El Paso, Texas. Sewage irrigation after treatment of sewage recommended by G. M. Pierson, 1902, ii-25.

England:

- Bacterial methods. By L. P. Kinnicutt, 1900, ii-218; By W. T. Hunt, 1901, i-65, 103, 229; 1901, ii-272.
 Review of work on the bacterial treatment of sewage by L. P. Kinnicutt. Septic tanks. Contact beds. Intermittent continuous filtration. 1902, ii-146, *153, 238.
 Bacterial contact beds. Solution of problem by Mr. Scott-Moncrieff. 1903, i-474.
 British view of bacterial treatment. By Samuel Rideal, 1903, ii-375.
 "Bird's-eye view of some twenty-five British sewage works." 1904, i-442, 542.
 Mersey and Irwell drainage areas, Extent of work done in. Report of R. A. Tatton. 1904, ii-443.
 English and American ideas on purification. 1901, ii-265, 272; 1904, ii-310.
 Exeter, England. Septic tanks and bacterial contact beds. 1903, i-*343.
 Filtration through coke. London experiments. Report on sewage sludge deposits by Prof. Clowes and Dr. Houston. 1900, i-157.
 (See also above, Depew, N. Y.)

Fitchburg, Mass. Intermittent filtration recommended by F. C. Coffin. 1901, ii-1.

Fond du Lac, Wis. Electric sewage pumps, septic tanks and contact filter beds. By G. S. Pierson, 1902, i-*410, 485.

Glasgow. 1901, ii-274.

Glen View, Ill. Septic tank and contact beds. By J. W. Alvord, 1902, ii-460.

Glencoe, Ill. Septic tank and double contact filter beds. By H. D. Wyllie, 1901, ii-*313.

Glenwood Children's Home, Mahoning County, Ohio. Intermittent filtration. 1902, i-*98.

Grease extraction, Cassel, Germany. 1903, i-*54.

Guadalajara, Mexico. Broad irrigation. 1900, i*369.

Highland Park, Ill. Septic tank. By J. W. Alvord, 1902, ii-460.

Holland, Mich. Septic tanks. By J. W. Alvord, 1902, ii-460.

Hopedale, Mass., Draper County. Septic tanks, pump wells and filter beds, sewage flow, and sewage analyses. By Leonard Metcalf, 1901, i-*298.

Huddersfield, Eng. Investigation of bacterial and other methods. By K. F. Campbell, 1901, ii-273.

Incubation tests, Studies of. By H. W. Clark, 1902, ii-446, 449.

Intermittent filtration:

Continuous filter, Construction of. By F. W. Stoddart, 1902, ii-139.

Continuous filtration in England. Review of work and filters. By L. R. Kinnicutt, 1902, ii-154.

German experiments. Pamphlet by Dunbar and Thumm. 1902, i-291.

Stability of sewage effluents from coarse filters. By H. W. Clark, 1902, ii-445, 449.

(See also under Sewage purification, Brentwood, N. H.; Brockton, Mass.; Clayton; England; Fitchburg; Fond du Lac; Glencoe; Glen View; Glenwood; Island Park; Lake Forest; Leicester, Mass.; Madison, Wis.; Manchester; Montgomery; Montreal; New Britain, Conn.; Pawtucket; Pittsfield; Ridgefield; Shelby.)

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Sewage purification: (Continued.)

- Island Park resort, Rome, Ind. Septic tank and filter beds. By G. S. Pierson, 1902, ii-*70.
- Lake Forest, Ill. Septic tank and sand filter beds. By W. S. Shields, 1902, i-95; By J. W. Alvord, 1902, ii-460.
- Leeds, England. Bacterial filter bed experiments. Report by W. T. Hunt. 1900, ii-183.
- Leicester, Mass. Intermittent filtration. Notes on plant, gagings and sewage analyses. 1900, i-231.
- London. Experimental coke beds. Reports on sewage sludge deposits by Prof. Clowes and Dr. Houston. 1900, i-157; 1901, i-65, 103.
- Los Angeles, Cal. Proposal to convert portions of outfall sewer into a septic tank. Broad irrigation. Opposition to sewage farming. 1900, ii-317; 1901, ii-65.
- Madison, Wis.:
 Contractors abandon plant, taken in hand by city. 1900, i-40.
 Unsuccessful operation of plant. Combined chemical precipitation and rapid filtration. Report of Prof. Turneure. 1900, ii-253.
 Plant abandoned, Jan. 2, 1901. 1901, i-177.
 New plant. Septic tank and rapid filtration. By F. E. Turneure, 1901, ii-286, 351.
 Plant forfeited to the city by the contractor. 1902, i-181.
- Manchester, England:
 Plans adopted by city council, including septic tanks, bacterial beds and broad irrigation. 1900, ii-221.
 New works for biological treatment of sewage. By J. P. Wilkinson, 1902, ii-482.
- Melbourne and Metropolitan Board of Works, Australia. Results with sewage farm. 1901, i-69.
- Mersey and Irwell District, England. Notes from the report of R. A. Tatton. 1902, ii-261.
- Minnesota. Purification made compulsory by the State Board of Health. By H. M. Bracken, 1904, i-79, 128, 138.
- Montgomery County Infirmary, Dayton, Ohio. Intermittent filtration. By B. H. Flynn, 1901, ii-*179.
- Montreal, Quebec, St. Denis Ward. Sewage farm. 1900, i-*54.
- New Britain, Conn. Intermittent filtration recommended. Estimated costs. 1900, ii-365.
- New Jersey. (See Sewage disposal, Passaic Valley, N. J.)
 Operation, Proper, of sewage plants. By J. W. Alvord, 1902, ii-448, 459.
- Pawtucket, R. I.:
 Septic tanks and rapid filtration. Results of experiments. By G. A. Carpenter, 1900, ii-435, 447.
 Old and new methods. Septic tanks and intermittent filtration. Results in 1900 and 1901. 1902, i-178.
 Patent infringement suit. 1904, ii-202, 215.
- Pittsfield, Mass. Intermittent filtration plant. 1902, i-*338.
- Percolating filters. (See above, Intermittent filtration.)
- Plainfield, N. J.:
 Proposed septic tanks, aerating weirs and double contact filter beds. 1901, i-17, 73.
 Royalties claimed for using septic tank and double filtration. Cameron, Glover and Mouras French patents. By J. O. Osgood, J. N. McClintock, 1901, i-101.
 Patent infringement suits of the American Sewage Disposal Co. against Plainfield and Pawtucket. By J. N. McClintock, 1904, ii-93, 133, 202.
 Temperature of air and sewage. 1904, i-72, 110.
- Princeton, Ill. Septic tank. By J. W. Alvord, 1902, ii-460.
- Reading, Pa. Sand washing and drying plant recommended. 1901, i-273.
- Ridgefield, Conn. Intermittent filtration plant. 1902, ii-342.

* denotes an illustrated article. † denotes an inset sheet.

Sewage purification: (Continued.)

- St. Louis, Mo., Washington University. Sewage studies and proposed septic tank. 1900, ii-329.
- Salford, England. Review of 12 years' experiments, by J. Corbett. Chemical precipitation and filtration. 1903, i-191.
- Santa Rosa, Cal. Experience of 12 years. Trial of septic tanks, settling tanks and upward filtration. 1902, ii-254.
- Saratoga Springs, N. Y. Relation to water waste and water meters. Combined board of sewer and water commissioners proposed. 1900, i-144, 176.

Septic tanks:

- Anchoring concrete steel lining. By W. H. Clay, 1902, ii-*130.
- English experience. 1900, ii-164, 172.
- Explosion at Sheringham, Norfolk County, England, May 1, 1903. 1903, i-441.
- Final disposition of solids in sewage treated in various septic tanks, England. 1902, ii-156.
- German experiments with septic tanks and contact filter beds. Pamphlet by Dunbar and Thumm. 1902, i-291.
- Management of tanks and bacterial contact beds. By G. J. Fowler, 1901, ii-193, 196.
- Notes by J. N. McClintock, 1902, ii-311; By F. M. Thomas, 1904, ii-405.
- Patents, Cameron, Glover and Mouras French. By J. O. Osgood, J. N. McClintock, A. W. Dudley, 1901, i-101, 137, 230; 1901, ii-176; 1903, i-302.
- Progress throughout the world. Report at meeting of Septic Tank Syndicate, Exeter, England. 1902, i-265.
- Proper operation of sewage purification plants. By J. W. Alvord, 1902, ii-448, 459.
- Tabulated details relating to the 17 different installations in Great Britain, Ireland and America. 1900, ii-329.
- Various supplemental processes. By W. S. Shields, 1902, i-95.
- (See also under Sewage purification, Brentwood, N. H.; Brockton, Mass.; Clayton; Columbus, Ohio; Connecticut; Cornell University; Danville, Ky.; DeKalb, Ill.; Depew, N. Y.; Exeter, Eng.; Fond du Lac; Highland Park; Glencoe; Glen View; Holland, Mich.; Hopedale, Mass.; Island Park; Lake Forest; Los Angeles; Madison; Manchester; Pawtucket, R. I.; Plainfield, N. J.; Princeton; Santa Rosa; St. Louis, Washington University; Shelby; Victoria, B. C.; Wauwautosa; Wheaton, Ill.; Worcester.)
- Shelby, Ohio. Septic tanks, settling basin and intermittent filters. By B. H. Flynn, 1902, ii-*434.
- Sludge. Coke filter beds. London experiments. Report by Clowes and Houston. 1900, i-157.
- Sludge reduction and grease extraction plant at Cassel, Germany. 1902, i-*54.
- Sludge removal without drawing off liquid, Bristol, England. 1902, ii-121.
- Small works for small populations. Suggestions by A. J. Martin in "Public Health Engineer." 1904, ii-492.
- South Australia, at Glenelg. 1904, ii-508.
- United States. Summaries concerning sewerage purification plants. 1900, ii-286; 1902, i-275.
- Victoria, B. C., Provincial jail. Septic tank and broad irrigation. 1904, i-*199.
- Waterbury, Conn. Recommendations of Rudolph Hering. 1900, ii-437.
- Wauwautosa, Wis. Septic tank and sand filter beds. By W. S. Shields, 1902, i-95; By J. W. Alvord, 1902, ii-460.
- Wave beds. (See above, Depew, N. Y.)
- Wheaton, Ill. Septic tank. 1903, i-158.

"1900, ii-112" means Year, 1900, second volume, page 112."

Sewage purification: (Continued.)

Worcester, Mass.:

Experiments on treating acid iron sewage in a closed septic tank.

By L. P. Kinnicutt, H. P. Eddy, 1902, i-436, 445.

Treatment of sewage in large open septic tank. Report of H. P. Eddy. Results tabulated. 1902, i-435.

Experiments with a small closed septic tank. Report of Connecticut Sewerage Commission. 1903, i-311.

Sewage storage well, Concord, Mass. Difficulties encountered in building well.

By Leonard Metcalf, 1900, i-422.

Sewage temperature, Brockton, Mass. Temperature at reservoir, at beds and of effluent. 1900, i-213.

Sewer forms. (See Concrete molds.)

Sewer gages:

Milwaukee, Wis. Automatic registering apparatus. By R. T. Logemann and R. A. Nommensen, 1901, i-408.

Sheboygan, Wis. Sewer gaging weir on automatic recording apparatus. By R. T. Logemann and R. A. Nommensen, 1901, i-407.

Waltham, Mass. Winslow type of gage records automatically. 1900, i-163.

Sewer gagings:

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Fond du Lac, Wis. Hourly flow Feb. 7 and 8, 1902. 1902, i-412, 485.

Hopedale, Mass., Draper Co.'s plant. Weir gagings made Aug. 25-28, 1899.

By Leonard Metcalf, 1901, i-298.

Leicester, Mass. Flow of 24 hours. 1900, i-231.

Milwaukee, Wis. Storm water flow. Registering apparatus. By R. T. Logemann and R. A. Nommensen, 1901, i-407.

North Metropolitan sewerage system of Massachusetts. Current meter readings taken in July, 1896, Dec., 1897, and June, 1900, below Charleston and East Boston pumping stations. 1901, i-193.

Sheboygan, Wis. Dry weather flow. Sewer gaging weir. By R. T. Logemann and R. A. Nommensen, 1901, i-406.

Toronto, Ontario. Gagings of dry weather flow in 1900. By C. B. Smith, 1901, ii-151.

United States and Canada. Gagings at various places. By R. T. Logemann and R. A. Nommensen, 1901, i-407.

Waltham, Mass. Winslow type of gage records automatically volume of flow. 1900, i-163.

Sewer gas explosions, Cause and prevention of. By C. H. Liedbeck, 1904, ii-270, 335.

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Jointing material, Sulphur-sand. By Alexander Potter, 1904, i-231.

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Steel and concrete, Paris. Framework of steel wire embedded in concrete. 1900, ii-73.

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Y-branches:

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Use of wooden studs to locate Y's. By H. P. Farrow, G. E. Manning, Ernest McCullough, Edward Mohun, 1904, i-37, 106, 203, 258, 354.

Sewer siphon, New York City, at 149th Street and Railroad Avenue. 1902, i-239.

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* denotes an illustrated article. † denotes an inset sheet.

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 Chicago. Suggested improvement of system by George W. Jackson. 1902, ii-491.
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 Report of Samuel M. Gray, June 5, 1900, to Chief Engineer of Havana.
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 Lebanon, Ind. Notes on new system. 1903, i-76.
 Liernur pneumatic system. Stansted, England. 1902, ii-371.
 Melbourne and Metropolitan Board of Works, Australia. Sewerage system and sewage farm. Hydraulic shield tunneling. By G. H. Dunlap, 1901, i-69, *106, 251.
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"1900, ii-112" means "Year, 1900, second volume, page 112."

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 Coldwater, Mich. Concrete sewer construction. By H. V. Gifford, E. J. McCaustland, 1902, i-*96, 154.
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- Indianapolis, Ind. By W. Buehler, 1903, ii-*50.
 Syracuse, N. Y. Solvay Process Co. 1902, i-355.
 Triple sewer outlet, Brooklyn. Specifications. 1903, i-*8.
 Egg-shaped sewers. Formulas for computing quantities of brickwork. By P. P. Farley, S. M. Swaab, G. S. Pierson, W. J. Roberts, 1900, i-*258, *327; By J. C. Meem, F. S. Bailey, C. H. Tuttore, 1900, ii-28, 94.

- Indianapolis, Ind. Northwestern Ave. Steel and concrete construction. By W. Buehler, 1903, ii-*50.

- Infiltration of ground water into sewers. Report of Mass. State Board of Health. Experience of various cities. By J. N. Hazlehurst, Kenneth Allen, J. G. Richert, E. W. Branch, 1903, ii-179, 182, 319, 391.

- Lake Bluff, Ill. Combined system of sanitary and storm water sewerage. By W. T. Griffith, 1901, i-*423.

- Lining of concrete sewers. 1904, ii-93, 132.

- Los Angeles, Cal. Converting portions of sewer into a septic tank. Letter from F. H. Olmstead. Report of Homer Hamlin. New outfall sewer. 1900, ii-317; 1903, i-116; 1904, ii-150, 244.

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- St. Louis, Mo. Repairing badly worn sewer inverts. By E. A. Hermann, 1904, i-*120.
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 - Triple sewer outlet, Brooklyn. Concrete and expanded metal. Wharf construction. Cement and mortar. 1903, i-8.
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- Storm flows from city areas, and their calculation. Formulas. Kuichling's method with variations. By E. W. Clarke, 1902, ii-386.
- Storm water overflows in intercepting sewers, Fond du Lac, Wis. By G. S. Pierson, 1902, i-*411.
- Support of pipe sewers. 1904, ii-268, 544.
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- Wooden sewer. Special construction for New York City in connection with Rapid Transit Ry. 1902, i-*236.
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- York, Pa. Criticism of the specifications for a new sewer system. By Alexander Potter, Hering and Fuller, 1904, i-*308, 354.
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 - Salt mine development at Grand Cote Island, Louisiana. Difficult work. By J. N. Hazlehurst, 1901, ii-*342.
- "1900, ii—112" means "Year, 1900, second volume, page 112."

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* denotes an illustrated article. † denotes an inset sheet.

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Fire protection. Mutual fire insurance. Report by Edward Atkinson. 1900, i-360.

Fiske Brick Co., Dover Point, N. H. Automatic machinery in the making of bricks. Elimination of hand labor. By J. P. B. Fiske, 1903, i-56, *63.

Lehigh Valley R. R., Sayre, Pa. Extensive improvements. 1903, i-465, *570.

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Morden Frog & Crossing Co. Tests of electric driving equipment. By M. F. Moore, 1903, i-472.

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Automatic stop system as an auxiliary. "The safe course." By Charles Hansel, 1903, i-299, 300.

Automatic stop system, Essentials of a successful. By F. E. Kinsman, 1903, i-432.

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Automatic stop systems in conjunction with block signals. Report of Illinois Railroad & Warehouse Commission. By S. W. Rushmore, 1902, i-155; By L. T. Boyle, G. W. Stadly, 1903, i-174, 180, 196; By G. G. Wacker, 1904, i-*108.

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Progress of system on American railways, Report of American Railway Association. 1902, ii-129.

Use of three-position, separate home and distant and overlapping automatic block signals. Report of Railway Signaling Club. 1903, ii-440.

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Cincinnati Southern Ry. Block signals and interlocking system. 1902, i-144.

* denotes an illustrated article. † denotes an inset sheet.

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Pipe connected signals for mechanical interlocking. Experience of Penn. R. R. and Chic. & East Ill. R. R. By G. S. Pfasterer, 1900, i-173.

Pneumatic crossing gates and signals, Del., Lack. & West. R. R., Sherburn, N. Y. 1900, ii-53.

Questions as to progress and uniformity presented to Railway Signaling Club. By B. B. Adams, 1900, ii-311.

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"1900, ii-112" means "Year, 1900, second volume, page 112."

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Vision of railway enginemen and firemen in relation to signaling. By N. M. Black, 1904, ii-483.

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Slide rule computations for laying out curves. By Frank Cooper, H. T. Stiff, 1902, i-147, 214.

Slide rules for the machine shop as a part of the Taylor system of management. By C. G. Barth, 1903, ii-*512.

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Slope protection, Boynton system of willow sprouts and wire network. 1903, i-537.

Slope stake setting:

Discussion by Antonio Llano, A. Miller, H. P. Gillette, C. G. Wrentmore, O. H. Tripp, B. F. LaRue, I. G. Walker, J. B. Davis, T. S. Burr, J. B. Johnson, A. W. French, P. C. Ricketts, G. T. Prince, Oscar Schniedel, E. S. Gould, J. H. Griffith, Willis Whited, G. P. Starkweather, B. T. Killough, C. H. Tutton, J. N. Ambler, G. K. Hooper, J. L. Campbell, 1900, ii-46, 78, *182, 198, 264, 265, 281, 296, 298, *313, 314, 334, 335, 336, 355, 356, 389, 410, 429; By L. B. Merriam, H. P. Gillette, W. Finnel, 1901, i-11, 30.

Graphical method of setting. By J. M. Rudiger, 1903, ii-*111.

Setting angle stakes in laying out roads. By M. M. O'Shaughnessy, E. M. Boggs, 1901, i-418, 449.

Use of the solar attachment of a transit. By R. E. Parker, 1904, ii-*447.

* denotes an illustrated article. † denotes an inset sheet.

- Slope walls, Design and cost of, including cost of quarrying. 1903, i-524.
- "Slot system" of attaching shaft hangers and fixtures to concrete steel structures. By H. P. Jones, 1904, i-*210.
- Sludge. (See Sewage purification.)
- Smelting. (See Electric smelting.)
- Smelting house, A West African. By C. V. Bellamy, 1904, ii-*391, 403.
- Smith, Hamilton, Biographical sketch of. 1900, ii-300.
- Smokeboxes. (See Locomotive boilers and fireboxes.)
- Smokeyjacks, Swinging, for locomotive roundhouses. 1900, ii-*287; 1902, i-*38.
- Smoke-preventing steam-jet-device. 1903, ii-391.
- Smoke prevention:
- Chicago. City ordinance. 1902, ii-25; 1903, i-381.
 - Cleveland, Ohio. City ordinance. Lectures by C. H. Benjamin. 1900, ii-415.
 - Indianapolis, Ind. Experiments with various devices. By R. P. King, 1904, i-78.
 - Investigation by the Mutual Boiler Insurance Co. 1901, ii-136.
 - Locomotives. (See Locomotive boilers and fireboxes.)
 - Reports from various railways entering Chicago in response to circular letter of Western Railway Club. 1900, i-278.
 - St. Louis, Mo.:
 - Ordinance. Smoke Abatement Department. 1901, ii-249; 1902, ii-201.
 - Municipal legislation and work of the Smoke Abatement Department. 1903, i-134.
 - Report on smoke prevention. 1904, i-491.
- Smoley's Tables; some convenient methods of calculation by their use. By F. D. Davis, 1902, ii-542.
- Snow cleaning. (See Street cleaning.)
- Snow flanger, Ellis, Wisconsin Central Ry. 1901, i-*84.
- Snow plows:
- Jull cyclone, Colorado Midland Ry. Experience. 1900, ii-133.
 - Leslie rotary, Colorado Midland Ry. Experience. 1900, ii-133.
 - Use of plows on various railways. 1901, i-*84.
 - Wisconsin Central Ry. Use of plows and flangers. 1901, i-*84.
- Snow sheds, Eliminating, on deep cuts of mountain divisions of railways. Oregon Short Line. By W. P. Hardesty, 1903, ii-*330, 340.
- Social engineering. 1900, ii-444.
- Society of Naval Architects and Marine Engineers:
- Conventions. 1900, ii-362; 1901, ii-397; 1902, ii-454; 1903, ii-481; 1904, ii-480.
 - Membership, income, etc. 1903, i-510.
 - President F. F. Bowles. 1904, i-792.
- Society for the Promotion of Engineering Education:
- Conventions. 1900, ii-36; 1901, ii-27; 1903, ii-33, 36, 44; By J. L. Van Ornum, 1904, ii-222, 366.
 - Membership, dues, income, etc. 1903, i-511.
- Sodding, Methods and cost of. By Arthur Hay, 1904, i-514.
- Solar attachment for transits, Shattuck. 1902, ii-*149.
- Solar motors in California and Arizona. By A. L. Davenport, 1901, i-*330; 1903, i-204.
- Sound, Instrument for locating, called Topophone. 1901, i-419.
- Sounding:
- Device for use in shallow water. Devised by A. E. Collins. Used on River Yare, England. 1904, i-*563.
 - Dredged channels. Automatically recording sounding barge invented by R. M. Pardessus and used at New Haven, Conn. 1903, i-*548.
 - Machine designed by B. C. Rich at Indiana Harbor, Ind. Drum-shaped machine. By Otto Gersbach, 1902, ii-*99.
 - Raft used in Delaware River improvement work. 1902, ii-*8.
 - River sounding on the survey of the Danube River. Rapid work. Stadia rod used. 1903, ii-67.
- South Africa, Engineering and other matters. By J. H. Veasey, 1901, i-211.
- "1900, ii-112" means "Year, 1900, second volume, page 112."

South America. Lima to Iquitos. Rubber forests. Indian tribes. Railway construction. Risks of life on the Amazon. 1902, ii-*350; 1904, ii-89.

"Southern Review of Commerce." "Southern Trade Record." "The United States Trade Reports." 1900, ii-315, 356; 1902, i-192.

Spark arrester for locomotives, German invention. 1904, i-223.

Specifications:

Concerning permission to a contractor to depart from specifications. New Orleans controversy and attacks on Mr. Harrod. 1902, i-172.

Contradictory requirements for rock excavation. 1904, ii-333.

Discussion of two general clauses. "Omission in plans." "Powers of engineer." 1903, ii-543.

Engineer's point of view. True economy of air specifications. By R. C. Barnett, D. J. Hauer, 1904, i-Cons. News Sup., April 14, 28.

Fairness and unfairness of the contractor. 1903, ii-Cons. News Sup., July 9, 16, 23.

Form of specifications. 1903, ii-Cons. News Sup., Oct. 15.

Influence of specifications on commercial products. By C. B. Dudley, 1904, i-592.

Making of specifications. By C. B. Dudley, 1903, ii-39.

Overhaul and clearing clauses. By W. D. Taylor, H. H. Wadsworth, E. H. Beckler, P. F. Barr, E. G. Haines, E. J. Beard, 1904, i-330, 378, 379, 402, Eng. Lit. Sup., Mar. 17, Cons. News Sup., Mar. 27, May 19, June 9.

"Pencoyd Specifications for Railroad Bridges." Curious illustration of wholesale copying. 1904, i-400.

Prohibiting profanity among workmen. 1904, ii-267.

Railway construction, Need of uniform specifications. 1903, i-501.

Riprap specifications. Practice in specifying broken stone by weight. 1904, ii-333.

Schedule of general clauses to be used as a guide in drawing specifications. 1904, i-377, Cons. News Sup., Apr. 21.

Standard specifications. Work of the American Society for Testing Materials. 1904, i-582, 612.

Uncertain cost factors in tunnel work. 1904, ii-363.

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Speed recorders. (See Recorders.)

Spikes:

Hardwood plugs to hold spikes in soft wood ties. Suggestions by C. P. Sandberg. 1903, i-387, 548, *569.

Hardwood spikes tried on railways in France. 1901, ii-401.

Screw spikes as rail fastenings. 1904, ii-131.

Screw spikes invented by A. L. Smith of Worcester, Mass. 1904, ii-*176.

Screw spikes for railway track, Merits and early history of, in Europe. (From report by Dr. Von Schrenk.) 1904, ii-*175.

Standard spike in United States, Canada and Mexico. 1900, ii-142, 149, 430.

Spiking machine, Smith hand power. 1904, ii-*176.

Spiking and tamping machine, Electric, Paris, Lyons & Med. Ry. 1904, i-*597.

Spillways. (See Hydraulic formulas, Wasteways.)

Spirit levels on engineer's field instruments, Tests of spirit-level vials. By Harold Van Duzee, 1900, ii-*348.

Spraying device for cooling and aerating water. 1903, i-*321, 325, 393.

Springs:

Experiments on spiral springs. By C. H. Benjamin and R. A. French, 1901, ii-446, 458.

Peculiarities of springs. 1901, ii-457.

Springs and spring steel. By William Metcalf, 1903, ii-104.

Square feet, Reducing to square yards. By J. M. Rudiger, Horace Andrews, 1903, i-391, 432.

* denotes an illustrated article. † denotes an inset sheet.

Stadia field-book, Proposed. Criticisms of R. G. Doerflinger's scheme. By G. R. Doerfling, 1901, i-*308; L. F. Rondinella, Ernest McCullough, H. F. Allen, W. C. Bunnell, 1901, ii-*79, 89, 159.

Stadia rods:

Copper rod with aluminum slips. 1902, i-*151.

Danube River survey work. 1903, ii-*67.

United States and Mexico boundary survey. 1900, ii-*246.

Stadia slide rule, Cox. 1900, i-*232.

Stadia work:

Oswego-Mohawk canal surveys. By D. J. Howell, 1900, i-*418.

Planetable, Use of, for rapid work. By J. W. Hays, 1902, i-207.

Railway location. By H. P. Boardman, 1901, i-133, 153.

Stadia work without stadia cross wires. By Isaac Dox, 1904, i-203.

Stairways:

Electrical continuous spiral, London. 1902, i-395.

Reinforced concrete:

Ingalls Building, Cincinnati, Ohio. 1903, ii-*95.

New York rapid transit railway stations. 1904, i-*616.

Stairways, Moving:

Biarritz, France. 1904, i-48.

Dodge invention. By J. W. Reno, 1900, ii-*266, 297.

Reno inclined elevator. By J. W. Reno, 1900, ii-266, 297.

Standard, The, and its use in surveying. By Edward Riordan, 1903, ii-*185.

Standard time, Originator of. 1904, ii-544.

Standardizing Bureau of Weights and Measures, National, Need of Bill in Congress. 1900, i-360; 1900, ii-230; 1901, i-64.

Standpipes:

Coburg, Ontario. Damage by ice and the repairs made. By H. C. Hodgkins, 1904, ii-*135.

Concrete-steel:

Attleboro, Mass. 1904, ii-94, 202.

Hull, Mass. 1904, ii-596.

Milford, Ohio. 1904, i-*184, 306.

Electrolysis at Peoria, Ill. By D. H. Maury, 1900, ii-*39, 44, 410; By A. A. Knudson, 1901, i-*66.

Elgin, Ill. Failure, March 14, 1900. Details concerning pipe. Tests of material. Reports on failure. By W. D. Pence, 1900, i-185, *282, 284, 307, 326.

Hillsboro, N. D. Failure on April 20, 1901. 1901, i-313.

Hull, Mass. Concrete-steel standpipe at Fort Revere. 1904, ii-596.

Lincoln, Neb. Wind damage April 21, 1902. 1902, i-*390.

Madison, Neb. Steel pipe. By A. C. Koenig, 1902, ii-*526.

Peoria, Ill. Electrolysis. By D. H. Maury, 1900, ii-39, 44, 410; By A. A. Knudson, 1901, i-*66.

Quincy, Mass. Construction details. Surrounded by masonry tower. By Olaf Helweg, C. M. Saville, 1902, i-†219, 254.

Recording height of water in distant standpipes. 1904, i-590; 1904, ii-11.

Sanford, Me. Failure. By C. W. Sherman, 1904, ii-488, *507.

(See also Water tanks.)

Stanley Electric Co., Organization of. William Stanley's affidavit in suit brought by Westinghouse Electric & Manufacturing Co. 1902, ii-279.

Stations. (See Railway stations.)

Staybolts. (See Locomotive boilers and fireboxes.)

Steam:

Escape of steam through orifices. Experiments 1895-1896, at St. Etienne, France. By M. Rateau, 1901, ii-*204.

Exhaust steam heating systems. Losses from back pressure. By R. L. Gifford, 1902, i-453.

Regenerative treatment of exhaust steam. By M. A. Rateau, 1901, ii-*200.

Separation from oil. (See Oil separators.)

(See also Superheated steam and superheaters.)

"1900, ii—112" means "Year, 1900, second volume, page 112."

Steam boilers. (See Boilers; Locomotive boilers and fireboxes; Marine boilers.)

Steam engines:

Allen. Reminiscences of early high-speed engines. By C. T. Porter, 1903, ii-394.

Balancing of. By W. E. Dalby, 1902, ii-342.

Ball joint for packing Corliss valve stems. 1904, ii-*150.

Brown Corliss, Intramural railway power plant, St. Louis Exhibition. 1904, ii-*323.

Buckeye, Intramural railway plant, St. Louis Exhibition. 1904, ii-*321.
Central valve, American. Bullock Manufacturing Co. By E. T. Adams, 1900, ii-*386.

Clearance and economy in a small steam engine. Experiments at New Hampshire College of Mechanical and Agricultural Arts. By Albert Kingsbury, 1901, ii-458.

Compound. 4,000-HP. cross compound engine with direct-connected alternator for Brooklyn electric lighting station. 1901, i-*12.

Condensation in cylinders. Glass "revealers" for investigating condensation. Results of tests. By Bryan Donkin, 1900, ii-*318.

Connecting rod, Influence of, upon engine forces. By S. A. Moss, G. I. Rockwood, 1904, ii-541, 543, 595.

Corliss. Results of tests made on Rice & Sargent engine. By D. S. Jacobus, 1903, ii-10.

Differences in the construction of gas and steam engines. By P. Plantinga, 1903, i-67.

Double-eccentric Corliss engine. Lane & Bodley Co. Mill plant in China. 1901, i-*404.

Early high-speed steam engineering. Allen engine and Richards indicator. By C. T. Porter, 1900, ii-394.

Economy guarantees of high-speed simple engines. By E. J. Armstrong, 1900, ii-423.

Economy of the piston steam engine at the advent of the steam turbine. By J. E. Denton, 1904, ii-511.

Electric generating sets. Co-operation between engine and generator builders. By H. C. Ebert, 1900, ii-422.

Feed-water consumption of a 4-valve Corliss non-condensing engine at different loads. By G. H. Barrus, 1900, ii-337.

Fleming 4-valve engine direct connected to a 400-KW. generator, Construction and efficiency of. By B. T. Allen, 1903, ii-493, 516.

Fleming, for Intramural railway power plant, at St. Louis Exhibition. 1904, ii-324.

Flywheel capacity for engine-driven alternators. By W. I. Slichter, 1902, ii-515.

Formula, Approximate, for mean effective pressure. 1903, ii-13.

French quadruple-expansion, of 1,500 HP., at St. Louis Exposition. 1904, ii-*428.

Governing. Combination of the variable cut-off with throttling of the steam supply, Vienna, Austria, central station. 1900, ii-†70, 76.

Greenwald four-valve engine, St. Louis Exposition. 1904, ii-*510.

Hamilton-Corliss, St. Louis Exposition. 1904, ii-*509.

High steam economy. Tests on English engine by J. A. Ewing. 1903, i-480.

Jackets and reheaters. 1904, i-538.

Lane & Bodley Corliss, Intramural railway at St. Louis Exhibition. 1904, ii-*321.

Lubrication:

Eight cylinder oil pumps. Schaeffer & Budenberg. 1903, i-*98.

Positive oiling apparatus with sight-feed distribution. Henry Hamelle. 1900, ii-*106.

Measuring power required for sheet rolling mills. Tests at Jessop Steel Co. By H. G. Manning, 1903, i-*376.

* denotes an illustrated article. † denotes an inset sheet.

Steam engines: (Continued.)

Murray Corliss, Intramural railway power plant at St. Louis Exhibition. 1904, ii-*322.

Oil separating system. Experiments at Edison Co., Detroit, Mich. By L. M. Booth, J. R. Bibbins, 1902, i-*406, 415, 437, 522; By A. W. Buel, 1902, ii-34.

Reheaters:

Multiple-cylinder engines. Experience in the use of reheaters. By R. H. Thurston, 1900, i-333.

Tests to determine effect of reheating and high vacuum, made at Durham College of Science, Newcastle-on-Tyne. By R. L. Weighton, James Christie, Josiah Harmar, 1902, ii-*125, 128, 170, 237.

Reliability, regulation and costs. Diagram of floor-space required and curves of power-cost. By William McClellan, 1904, ii-582.

Requirements, for the parallel operation of alternators. Specifications in use by Westinghouse Electric & Manufacturing Co. By E. M. Tingley and H. E. Longwell, 1902, i-498.

Reynolds-Corliss, at St. Louis Exposition. 1904, ii-*509.

Rice & Sargent compound, using superheated steam. Tests. By D. S. Jacobus, 1904, i-27.

Schneider. Valves moved by hydraulic pressure alone. Paris Exposition. Proved a total failure. 1900, ii-*107, 421.

Semi-portable Wolf engine at Paris Exhibition. 1900, ii-107.

Single rotary valve. Built by W. J. Francke. 1903, i-*125.

6,000 HP. engine for rolling mill of Republic Iron & Steel Co. High speed valve gear. Quick-closing stop valve. 1902, ii-*138, 239.

Specifications, Westinghouse Electric & Manufacturing Co. Engine requirements for the parallel operation of alternators. By E. M. Tingley, 1902, i-498.

Specifications for installation. Suggestions of Engine Builders' Association. 1901, i-457.

Standardizing engine tests. Report by American Society of Mechanical Engineers. 1901, i-422.

Sulphuric anhydride attachment. Particulars of the waste-heat engine at the Berlin Electric Works. By E. F. Miller, 1902, ii-449, *456.

Sulzer triple-expansion:

Berlin Municipal Electric Lighting System. 1900, i-†61.

Tests by Prof. Schroeter, of Munich. Steam consumption of compound and triple expansion engines with saturated and with superheated steam. 1902, ii-259.

Superheated steam. (See Superheated steam and superheaters.)

Tandem-compound engine using superheated steam. Poppet valves. European engine. 1902, i-*268.

Tests to determine effect of reheating and high vacuum on steam engine economy, made at Durham College of Science, Newcastle-on-Tyne. By R. L. Weighton, James Christie, Josiah Harmar, 1902, ii-*125, 128, 170, 237.

Triple expansion:

Paris Exposition. 2,500-HP. engine and direct-connected alternator. 1900, i-†405.

Paris Exposition. 1,000-HP. compound engine with Lentz valve gear. 1901, i-†117.

Vienna, Austria, Leopoldstadt central station. High speed vertical engine of 1500-HP. Governing, combination of variable cut-off with throttling of steam supply. 1900, ii-†70, 76.

Valves. (See Valves.)

Westinghouse:

6,000-HP., for superheated steam. N. Y. Gas & Electric Light, Heat & Power Co. 1901, i-*375.

St. Louis Exhibition. 1904, ii-*224.

"1900, ii—112" means "Year, 1900, second volume, page 112."

Steam engines: (Continued.)

Willans central-valve engine at St. Louis Exposition. 1904, ii-*510.
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Steam hammers:

Bethlehem 125-ton, Demolition of. Other large hammers. 1902, i-*289, 354.
Nasmyth. Why it has not displaced the friction-clutch pile driver. 1903, ii-13.

Steam meter, Sargent indicating. By C. E. Sargent, 1904, ii-*535.

Steam motors:

British Board of Trade report on use of steam motor cars in Belgium and other places in Europe. 1902, i-241.

Cars for railway service. Experience of the N. Y., N. H. & H. R. R.; Erie R. R.; C. H., & D. Ry.; P., C., C. & St. L. Ry.; Erie & Wyoming Valley R. R. Schenectady cars, Baldwin cars, Cooke car, Roman car and others. 1902, i-*102, 112.

Possibility of designing a successful steam motor car. 1902, i-112.

Storage Power Co., N. Y. City. "Superheated water." Trial on N. Y. C. R. R. 1901, i-187.

Steam packing. (See Packings, Metallic.)**Steam pipe:**

Arrangement and construction of steam pipes and their connections. By R. C. Monteagle, 1903, ii-*487.

Coverings. (See Pipe coverings.)

Expansion joint, Balanced. H. B. Underwood & Co. 1900, ii-*194.

High pressure steam piping, Development of. By William Andrews, 1902, ii-525.

Specifications for copper pipe, seamless steel and lap-welded steel pipe of Bureau of Steam Engineering. By R. C. Monteagle, 1903, ii-487.

Swiveling joint for a 16-inch high pressure main. By R. E. Curtis, 1902, i-*468.

Steam pressure, Loss of, in steam pipes. Table. By A. F. Nagle, 1900, i-55.

Steam separator, Potter mesh, and superheater. 1901, ii-458.

Steam shovel track layer invented by W. B. Michel. 1904, ii-*103.

Steam shovel work:

Cost of earth excavation by steam shovel. By D. J. Hauer, 1903, ii-579.
Pitts., Carnegie & West. R. R. Cost of work. 1903, i-447.

Time required to load wagons. Records of a 45-ton Bucyrus. By J. S. Ely, 1904, ii-44.

Steam shovels:

"Atlantic," designed by A. W. Robinson. 1904, ii-*108.

Bucyrus, for sewer excavation in Chicago. 1901, ii-347.

Direct-acting cylinders. Kilgore Machine Co. 1903, ii-*545.

"Home-made" dipper dredge or steam shovel. 1903, i-*423.

Loading blasted rock onto cars, Aspen tunnel, Wyoming. By W. P. Hardesty, 1902, i-*188.

Massena, N. Y. Water power canal work. Steam shovels working in connection with traveling inclines. 1901, i-*130.

Rock cuts with, on Gallitzin tunnel of Penn. R. R. 1903, ii-*273.

Thew shovel, Cleveland, Lorain & Wheeling Ry. 1901, i-*260.

Trench machines made by the Chicago Transfer & Clearing Co. Vulcan machine, Bucyrus machine and King ditching machine. 1901, ii-*347.

Vulcan shovel. 75-ton machine used by the Chicago Transfer & Clearing Co. for excavating sewer trench. 1901, ii-*347.

Steam trap operated by flexible diaphragm. C. A. Dunham Co. 1903, ii-*570.

Steam turbines:

Advantages of, for textile mills. By A. R. Dodge, 1903, ii-*359.

Commercial aspect. Advantages of turbines for electric power plants. Experience with turbines. By E. H. Sniffen, 1902, ii-349, 360, 371.

* denotes an illustrated article. † denotes an inset sheet.

Steam turbines: (Continued.)

Curtis turbine. Successful operation. Possibilities of the gas engine
By A. R. Dodge, 1903, ii-229, *359; By W. L. R. Emmet, Francis
Hodgkinson, 1904, i-*552, *554.

De Laval turbine. Turbine applied to dynamo. Comparative efficiencies
of compound condensing engine and De Laval steam turbine. 1900,
ii-*106; 1901, ii-*315; By E. S. Lea, 1904, i-*551.

Different applications of steam turbines. By A. Rateau, 1904, i-*544.

Discussion at American Street Railway Association. 1904, ii-355.

Driving of electric generators on ships. 1902, ii-454.

Economy of the piston steam engine at the advent of the steam turbine.
By J. E. Denton, 1904, ii-511.

Exhaust steam in low-pressure turbines, Utilization of. By Leonce Battu,
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Experiments on the escape of steam through orifices, 1895-1896, at St.
Etienne, France. By M. Rateau, 1901, ii-*204.

Improvements in steam turbines. By J. J. Flather, 1903, i-7.

Parsons. Test of 1,340-HP. turbine at Elberfeld, Germany. "Turbinia"
at Paris Exposition. 1900, ii-*106, 173; By Francis Hodgkinson,
1904, i-*555.

Power house of Penn. R. R. tunnel through New York City. 1903, ii-328.

Rateau turbine. By A. Rateau, 1904, i-*546, *554, *555.

Reliability, regulation and costs. Diagram of floor space required and
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Seger turbine. 1900, ii-*106.

Ship propulsion:

Cunard line. Turbines for new ships. 1904, i-303.

Notes. By James McKechnie, 1901, ii-*144.

Tests of Yarrow torpedo boat. By A. Rateau, 1904, i-547.

Steam consumption tests on Westinghouse-Parsons turbine. By J. R.
Bibbins, 1904, i-216.

Stumpf turbine. By Francis Hodgkinson, 1904, i-*554.

Superheated steam in steam turbines. Economical power development.
Experiments by Lewicki at Dresden. 1902, i-318.

Tests at shop of Westinghouse Machine Co. Methods and results. By
J. R. Bibbins, 1904, i-*213.

Tests of turbines direct-connected to dynamos. 1901, ii-218.

Theoretical and practical considerations in steam turbine work. By
Francis Hodgkinson, 1904, i-*553.

Troubles experienced in the use of steam turbines. 1904, i-540.

Westinghouse-Parsons turbines, Yale & Towne Manufacturing Co., Stam-
ford, Conn. Operation. Results of economy tests at various
loads. By F. A. Waldron, 1903, i-569.

Zoelly turbine. By Francis Hodgkinson, 1904, i-*554.

Steamer shafts. 1900, i-394.

Steamers:

American-Asiatic Steamship Co. organized. 1902, ii-215.

Atlantic ships, Notes on. 1900, i-394.

Atlantic Coast Steamship Co. "Waccamaw." 1900, ii-289.

Atlantic Transport Co. Large steel passenger and freight ships, dupli-
cates of "Minneapolis" and "Minnehaha." 1900, ii-321.

"Baltic." When will the limit in size be reached? 1903, ii-520.

Brakes, Fin, on Canadian boat "Eureka." 1903, i-89.

Chain steamer on Main River, Germany. 1901, ii-†69.

"City of Trenton." (See Boiler explosions, Steamer.)

Coal consumption. (See Warships, Coal consumption.)

Coaling. (See Coal handling.)

Design and building of the 21,000-ton ships "Minnesota and "Dakota."

By C. R. Hanscom, 1904, ii-*186.

"Deutschland." Description and speed records. 1900, ii-37, 53, 101, 157,
173; 1901, ii-55.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Steamers: (Continued.)

- Dimensions of ocean steamships. 1901, i-319.
- Double-hulled combined river and gulf steamship. 1902, ii-57.
- Draft of vessels. Experiments with ship models at Washington, D. C. By D. W. Taylor, 1904, ii-*269.
- Draft of vessels in motion in shallow channels compared with their stationary draft. By H. N. Babcock, 1904, ii-101, 111.
- Electricity, Probable future developments in the use of. 1902, ii-454.
- Fire-trap construction on new steamer of Fall River Line. 1902, ii-474.
- Fuel economy. Particulars of cargo steamers for North Atlantic trade to illustrate fuel economy of large capacity ships. By James McKechnie. 1901, ii-139.
- "General Slocum." (See Fires, Steamer "General Slocum.")
- Greatest steamship lines in the world. 1900, i-281.
- "Hudson." Accident on marine railway in Baltimore harbor. 1901, ii-*178, 310.
- "Kaiser Wilhelm der Grosse." Speed record. 1900, ii-101.
- "Kaiser Wilhelm II." General description. 1902, ii-105, *241.
- "Kaiserin Maria Theresia." 1900, i-201.
- "Kronprinz Wilhelm." Speed records. 1901, i-253, 369; 1902, i-469; 1902, ii-201.

Lake steamers:

- "Gates," a freight steamer. 1900, i-105, 353.
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- Vessels for the Atlantic trade. Northwestern Steamship Co. of Chicago. 1901, i-345.
- "La Lorraine." First trip. 1900, ii-141.
- Leyland line purchased by Morgan & Co. 1901, i-313, 356.
- Maintenance of machinery in merchant ships. By Robert Haig, 1904, ii-470.
- Mississippi River. New type of light-draft steamboat. 1902, i-41.
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- North German Lloyd. Burning of ships and piers in New York harbor. 1900, ii-1, 26.
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- Oil tank, Largest ever built, by Scott & Co. 1903, i-265.
- Ore steamer "Grangesberg" for Baltic service. 1903, ii-141.
- Piston speed of various types of steamers. By James McKechnie, 1901, ii-141.
- Progress in steamship construction from 1812-1901. Graphical record. 1901, ii-*364.
- Racing steamboats and exploding boilers. "City of Trenton" on Delaware River. 1901, ii-145, 177, 195, 249.
- River tug "James Rumsey." Screw propeller. Ward sectional coil boiler. "Tug-of-war" with stern-wheel boat. 1903, i-245, *457.
- "St. Paul." Accident, broken shaft and wrecked engine. 1900, ii-305.
- "Saxonia" of the Cunard line. 1900, i-385.
- Screw shafts, Torsional vibrations in. Investigations by Blohm & Voss of Hamburg. 1902, ii-400.
- Shallow-draft steamer "Promontory" on Great Salt Lake. By C. W. Arthur, 1902, ii-*442.
- "Shawmut" of Boston Steamship Co. 1902, i-265.
- Size and tonnage of leading ocean ships. 1904, ii-44.
- Speed. Comparison of high-speed steaming. Weights and space occupied. By James McKechnie, 1901, ii-143.
- Speed records for 1900. 1901, i-71.
- Sprinkler systems to prevent fires, suggested. By E. U. Crosby, A. R. Bush, 1904, ii-73, 113.
- Steel ships, Resistance to fire. 1900, ii-27.

* denotes an illustrated article. † denotes an inset sheet.

Steamers: (Continued.)

- Steel specifications of International Association for Testing Materials. 1901, ii-11.
- Subsidies for American merchant vessels. Bill in Congress. 1900, ii-428.
- Tonnage facilities by compact stowage of cargoes. Importance of economizing. By H. P. Jones, 1901, i-150, 152.
- Turbine driven:
- English Channel service. "Brighton." 1903, ii-25, 304.
 - "King Edward," on the Clyde, compared with paddle-wheel steamer. 1901, ii-42; 1902, i-125.
 - Parsons patents. Fairlie-Campbeltown service, England. 1901, i-177.
 - Notes on turbine propulsion. By James McKechnie, 1901, ii-*144.
 - Tests of Yarrow & Co.'s boat. By A. Rateau, 1904, i-547.
- "Vaderland." Notes. 1901, ii-421.
- Yacht "Arrow." New speed record. 1902, ii-181.
- (See also Ferry steamers; Submarine boats; Warships.)
- Steaming radius and the most economical speed of steam vessels. Cruiser "Yosemite." Report of M. E. Cooley. 1900, ii-263.

Steel:

- Annealing and case hardening tool steel. By E. A. Spaulding, 1903, ii-376.
- Bessemer steel, Synthesis of. By F. J. R. Carulla, 1904, ii-19.
- Brittleness:
 - Plates made brittle by extreme cold. 1903, ii-304.
 - Test for detecting. Proposed. Nicked bending test. By J. P. Snow, 1904, ii-*88.
- Copper in steel. Investigations by J. E. Stead and John Evans. 1901, ii-136.
- Hay steel process and the first steel bridge in America. Glasgow, Mo. Chicago & Alton Ry. 1901, ii-53, 56, 75, 89.
- Heat treatment. American pioneers. Restoration of crystallized steel. Work done by W. A. Sweet. By J. A. Stead and A. W. Richards, 1903, ii-262, 268, 317, 525; 1904, i-144.
- High-speed tool steel. Discussion at American Society for Testing Materials. 1904, i-584.

Manufacture:

- Early history of open-hearth steel manufacture in the United States. By S. T. Wellman, 1901, ii-448.
- Germany. Progress in steel works practice, 1880-1901. Bessemer basic process. Open-hearth furnace practice. German iron trade conditions. Appliances in steel works. By R. M. Daelen, 1902, ii-240.
- Modern developments in the production of open-hearth steel. Basic process. Bertrand-Thiel process. Talbot process. Monell process. By James Christie, 1902, ii-107.
- Oxygen, Possible use of, in production of steel. By Charles Prelini, 1900, ii-9.
- Talbot open-hearth continuous steel process. Pencoyd Steel Works. By Benjamin Talbot, 1900, ii-31.
- Use of naphtha residue called "mazout," in Russia. 1901, ii-407.
- Melting steel with cast iron. Tests of bars cast from "semi-steel" mixtures. By R. P. Cunningham, 1903, i-309.
- Microstructure of the steel in a defective circular saw. By J. A. Aupperle, 1901, i-*162.
- Microstructure, and fractures in steel rails. Experience on the Phil. & Read Ry. By Robert Job, 1903, ii-*66.
- Nicked-bending test suggested by J. P. Snow. 1904, i-586.
- Nickel. (See Nickel steel.)
- Physical requirements for steels for Manhattan bridge. 1903, ii-521, 526.
- Prices and production. (See Iron and steel.)
- Protection. (See Iron and steel, Coatings; Iron and steel, Protection.)
- Rail-steel, Notes on. By R. W. Hunt, 1904, i-232.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Steel: (Continued.)

Recovery of steel from overstrain and the effect of time and temperature. Tests at McGill University. 1901, i-416.

Resistance of steel, Tests of, by General Electric Co. Tests for electric conductivity with special reference to conductor-rails. By J. A. Capp, 1903, ii-*381.

Restoration of dangerously crystallized steel by heat treatment. By J. E. Stead and A. W. Richards, 1903, ii-262, 268, 317.

Specifications. (See Iron and steel, Specifications.)

Temperatures. Effect upon steel of work at different temperatures. By C. H. Ridsdale, 1901, ii-*238, 265, *276.

Tensile impact tests at Purdue University. By W. K. Hatt, 1904, ii-*205.

Tests. (See Iron and steel, Tests.)

Titanium, Influence of, on the properties of cast-iron and steel. By A. J. Rossi, 1901, i-386.

Tool steel:
Development of tool steel. By E. L. French, 1902, ii-234.

Effect of composition on hardening qualities. Swedish exhibit, Paris Exposition. 1900, ii-48.

High-speed tool steel, Bismarck furnace, Silesia, Germany. 1902, ii-413.

Taylor-White process. Bethlehem Steel Co. Specifications. 1900, ii-91; 1901, i-313.

Vanadium steel introduced in France. 1902, ii-1.

Steel ingots:
Blowholes in steel ingots. 1902, ii-*261.

Compressing steel ingots by wire drawing in the ingot mold. Process at St. Etienne, France. Apparatus described by A. Harmet. 1902, ii-*262.

Piping, Prevention of, German method. 1903, ii-466.

Steel manufacturers' consolidation. (See United States Steel Corporation.)

Steel scrap, Use of, in the foundry. By W. G. Scott, 1904, i-611.

Steel scrap, Use of, in the foundry. By W. G. Scott, 1904, i-611.

Steel scrap, Use of, in the foundry. By W. G. Scott, 1904, i-611.

Steel scrap, Use of, in the foundry. By W. G. Scott, 1904, i-611.

Steel scrap, Use of, in the foundry. By W. G. Scott, 1904, i-611.

Steel scrap, Use of, in the foundry. By W. G. Scott, 1904, i-611.

Steel scrap, Use of, in the foundry. By W. G. Scott, 1904, i-611.

Steel scrap, Use of, in the foundry. By W. G. Scott, 1904, i-611.

Steel scrap, Use of, in the foundry. By W. G. Scott, 1904, i-611.

Steel scrap, Use of, in the foundry. By W. G. Scott, 1904, i-611.

Steel scrap, Use of, in the foundry. By W. G. Scott, 1904, i-611.

Steel scrap, Use of, in the foundry. By W. G. Scott, 1904, i-611.

Steel scrap, Use of, in the foundry. By W. G. Scott, 1904, i-611.

Steel scrap, Use of, in the foundry. By W. G. Scott, 1904, i-611.

Steel scrap, Use of, in the foundry. By W. G. Scott, 1904, i-611.

Steel scrap, Use of, in the foundry. By W. G. Scott, 1904, i-611.

Steel scrap, Use of, in the foundry. By W. G. Scott, 1904, i-611.

* denotes an illustrated article. † denotes an inset sheet.

Stone:

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Strength, Influence of finish on. By I. H. Woolson, 1904, i-331, 401.

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Stone crushers:

Centrifugal roll crusher, Sturtevant Mill Co. 1900, i-*156.

Cost of crushing stone by a municipal crushing plant, Baraboo, Wis. By W. G. Kirchoffer, 1902, i-258; 1903, i-55; 1904, i-210.

Sectional crusher for mining work. National Drill & Manufacturing Co. 1904, ii-*135.

Stone dressing machines, Pneumatic, at the Wachusett dam, Clinton, Mass. Kotten machine and Dallett machine. 1904, i-*622.

Stone tongs for lifting cut-stone, French device. 1900, i-*13.

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Storage batteries:

Edison new battery. 1901, i-385, 416.

Eyanson battery. 1901, i-376.

Historical review. Use of pyroxyline. By H. B. Coho, E. A. Sperry, 1903, i-373.

Precautions in the installation of. 1904, i-468.

Value of, as auxiliaries to power plants. By W. E. Harrington, 1901, ii-294.

Value in small stations. 1900, ii-53.

Storage tanks. (See Bins.)

Storror, Charles Storer, Biographical sketch of. 1904, i-*422.

Strainer, Lift, for suction pipe foot-valves. 1903, ii-*509.

Strainer and sand trap for driven and artesian wells, Etheridge. 1900, ii-*96.

Stream flow. (See River gagings.)

Streams. (See Rivers.)

Street car brakes. (See Brakes.)

Street cleaning:

Chicago. Aldermen acting as superintendents. Financial difficulties. 1901, i-305; 1903, ii-58.

Cincinnati, Ohio. Notes. 1901, ii-23.

Detroit, Mich. Methods. 1902, ii-173.

Great Britain. Notes on report of Association of Cleansing Superintendents of Great Britain. 1900, i-272.

Milwaukee, Wis. Cost of sweeping in 1899. 1900, ii-449.

San Francisco, Eight different methods of cleaning the streets of. By L. M. King, 1903, ii-169.

Snow removal:

Brooklyn, N. Y. Safeguards to secure low prices on municipal contracts. 1900, ii-388.

Montreal. Cost of removing snow 1898-1899. Cost for five years ending Nov. 1, 1899. 1900, ii-449.

Statistics for 40 American cities, 1899. Compiled by Andrew Rosewater. 1900, i-136, 178.

Statistics for cities above 3,000 population in the United States. By A. P. Folwell, 1902, ii-422.

Washing asphalt pavements with hose streams. 1904, ii-454.

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Street dust, Bacterial studies of, in Lafayette, Ind., and in New York. By D. B. Luten and Severance Burrage, 1900, ii-*242; 1902, ii-429.

Street dust and disease. 1903, i-76.

Street improvements, Assessments for. Supreme Court decisions. 1901, i-432.

Street lighting, Gasoline, Muscatine, Iowa, proposed. 1903, ii-578.

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Street Railway Accountants' Association, Convention. 1903, ii-231.

Street railway fares:

Chicago, Graded system of fares on Chicago General Railway. 1900, i-17.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Street railway fares: (Continued.)

- Union Traction Co. of Indiana. Schedule. 1902, ii-399.
- Washington, D. C. Schedule. 1900, i-49.

Street railway franchises:

- American cities. Information compiled by E. F. Mack. 1900, i-13, 49.
- Brussels, Belgium. Revision of franchises. Conditions of agreement. 1901, ii-494.
- Municipal control of, in Chicago. Suggested by Geo. C. Sikes. Editorial in Chicago "Tribune." 1901, ii-348, 388.

Street railway terminals, Buffalo, N. Y., Pan-American Exposition. 1902, ii-*368.**Street railways:**

- Chicago. Report of Street Railway Commission. Bill before City Council. Municipal ownership advocated. 1901, i-1, 28, 39, 57.
- Municipal charges, Foreign practice. 1901, i-409.
- New York City. Report by Merchants' Association. Proposed Railway Commission for New York. Crowding on elevated and surface lines. 1903, i-34, 89, 174; 1903, ii-252.
- Oppression of street railway corporations by municipalities. Address by H. H. Vreeland at Detroit. 1902, ii-315, 323, 336.
- Philadelphia. Bill in legislature. Efforts of rival companies. 1901, i-425. (See also Electric railways.)

Street-refuge isle. (See Refuge isles.)**Street sprinkling:**

- English practice. 1900, i-273.
- Oil on macadam roads in Massachusetts. Tar used abroad. 1902, ii-281, 312.
- San Francisco, Cal. Experiments by Merchants' Association. 1900, i-353. (See also Water rates.)

Street sprinkling trolley cars:

- American Car Sprinkler Co. 1901, i-*395.
- Brill. Spray reinforced by compressed air. 1902, ii-*210.
- Studebaker. Spray controlled by pressure pumps. 1901, ii-*358.

Street sprinkling wagons, Specifications. Brooklyn, N. Y. 1902, ii-94.**Street sweepers:**

- German pick-up sweeper with its own sprinkler. 1903, i-*511.
- Trolley car attachment, Cleveland, Ohio. 1901, ii-97.

Street sweepings:

- Disposal of. 1900, i-76.
- New York City. Notes on bids and contracts. 1901, ii-297.
- San Francisco, Cal. Disposal of. 1901, ii-187.

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- Accidents from moving vehicles, New York City. 1903, ii-454.

Gutters:

- Diagram for determining size of. By Emmett Steece, 1902, i-309.
- Gutter in center of street, Trinidad, Cuba. 1903, i-505; 1903, ii-13.

New York City:

- Widening of Fifth Avenue. 1901, i-358.
- Widening of 59th Street. 1903, ii-454.

- Parking wide city streets, Columbus, Ga. By R. L. Johnson, 1901, ii-*363.
- Refuge isles in city streets, New York City. Design for electric light standards. 1902, ii-73, *90.

- St. Louis, Mo. Notes on pavements, cleaning, etc. 1904, i-620.

- Steel wheelways for city traffic. (See Rails, Highway traffic.)

- Traffic on American streets. 1902, ii-312.

- Traffic on city streets. "Censuses of street travel." Proposed blank forms for taking census. By S. Whinery, 1903, ii-370.

- Width of city streets in large cities of the world. 1900, i-293.

- (See also Pavements, Width.)

- (See also Pavements; Roads.)

* denotes an illustrated article. † denotes an inset sheet.

Stremmatograph tests of fiber strains in rails under moving locomotives. By

By P. H. Dudley, 1903, ii-127.

Stresses:

Circular plates, Stresses in. Plate subjected to uniform fluid pressure and supported around the circumference. By I. P. Church, Edward Godfrey, Luigi d'Auria, H. S. Richmond, 1900, i-*10, *162, *227; 1900, ii-9, *94; 1903, i-14, 105.

Concrete arch over Big Muddy River, Ill. Cent. R. R. By H. W. Parkhurst, 1903, ii-*425.

Definition of stress. By J. B. Webb, 1903, i-39.

Diagram for finding pier moments on continuous spans. By C. E. Young, 1901, ii-360.

Hoops for water tanks, Stress diagram for. By Ballinger & Perrot, 1903, i-218.

Masonry and concrete arches. Notes on notable bridges. By L. J. Johnson, Carl Gayler, D. B. Luten, A. W. Buel, 1902, i-*362, 483.

Moment diagram for axle loads. By B. R. Leffler, 1904, ii-10.

Nature of shearing stress. By Charles Worthington, 1904, ii-*315.

Riveted connections, Polar moment of inertia. By C. F. Blake and R. W. Runge, 1903, i-*461.

Signs used to indicate stress. 1904, ii-Eng. Lit. Sup., Dec. 15.

Skew arches, Stresses in. By W. C. Kernot, 1903, i-*529.

Temperature stresses in aluminum transmission wires. By R. D. Johnson, 1902, ii-382, 501.

Temperature stresses in stiffening trusses of suspension bridges. Discussion in connection with the Brooklyn bridge. By Joseph Mayer, Edwin Duryea, Jr., Gustav Lindenthal, 1901, ii-350, 409, 453, 474.

Three-hinged arches, New graphical method for. By J. W. Balet, 1904, ii-356.

Unit stresses and impact in old railway bridges. By A. F. Robinson, 1902, ii-244.

Strikes:

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Concerning strikes. By A. F. Nagle, A. J. Steers, 1902, i-480, 503.

Croton dam, New York. Italian laborers. 1900, i-259.

Public interest in the anthracite mine strike. 1902, ii-146.

Sturtevant, B. F., Co., Hyde Park, Mass., Works. By W. B. Snow, 1902, ii-357.

Submarine boats:

"Adder," "Moccasin," "Grampus" and Protector." 1902, ii-373, 389, 421, 429, 461.

Berger submarine torpedo boat tested, Washington Navy Yard. 1900, ii-305.

Calcium carbide, Use of, for raising and sinking boat. 1903, ii-387.

Development and future possibilities of the submarine boat for both naval and commercial purposes. Review of Mr. Holland's discussion. 1901, i-29.

Drilling and blasting boat in Boston harbor. 1902, ii-148.

Early torpedo boats. By G. W. Baird, 1902, ii-*195.

"Fulton" launched. 1901, i-441.

"Holland." Notes. 1900, i-86, 260; 1901, i-71, 286.

"Raddatz" tested at Milwaukee, Wis. 1900, ii-53.

Submarine telegraphs:

Pacific cable. 1902, ii-112, 437; 1903, ii-25.

Statistics of the world. 1902, ii-181.

Submarine telephone cable on England-Belgium line. 1903, ii-*110.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Subsidence of the land and of the harbor bottom at Boston. From the report of J. R. Freeman on the proposed Charles River dam. 1903, i-544, 546.

Subsidies for American merchant vessels. Bill in Congress. Cost of ship-building in America and Europe. 1900, ii-428; 1901, i-10.

Subways:

Bloomington, Ill. Concrete conduit construction for Consumers' Heat & Electric Co. 1901, i-*280.

Boston. Pedestrian subway under car tracks on Travers Street. 1900, i-*16.

Boston Navy Yard. Proposed subway for pipes and wires. 1902, ii-102.

Chicago passenger railway, Subway proposed. 1900, ii-85; 1901, i-88; 1902, ii-44, 65; 1904, i-279; 1904, ii-*568.

Chicago telephone tunnel system. 1901, i-*328; 1902, i-205; By John Ericson, 1902, ii-*44, 65, 239; 1903, i-*166; 1903, ii-256; 1904, i-*251; 1904, ii-508.

Electric. Statistics of underground electric wires in the United States. 1902, i-292.

Explosions:

Baltimore electrical subway, Nov. 11, 1900. 1900, ii-332.

Boston gas explosion March 4, 1897. Boston Gas Co. responsible. 1900, ii-273.

New Orleans. Opportunity to construct subways for pipes and wires. 1900, i-288.

New York subways for pipes and wires. 1900, i-176, 265; 1900, ii-332, 358, 381; 1903, ii-389; 1904, i-12, *16, 376.

Objections to subways. Systematic location of pipes and wires in earth advocated by Mr. McDonald, Louisville, Ky. 1900, ii-120.

Review of subways built for pipes and wires in England and cities of the United States. 1900, i-*176.

St. Helens, England, for street pipes. 1900, i-*177.

Waterproofing subway under railway track. 1900, i-*222.

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Sugar plantation in the Sandwich Islands, Irrigated. By C. H. Kluegel, 1904, i-269.

Sulphur, Russian deposits. By H. L. Geissel, 1901, i-125.

Sulphurous anhydride, Pressures and temperatures of saturated vapor of. Table. 1903, ii-516.

Sun-prints. (See Blue printing.)

Sunstroke, Rules for guarding against. 1904, i-610.

Superheated steam and superheaters:

Boston Edison Electric Illuminating Co. By I. E. Moulthrop and R. E. Curtis, 1902, i-466.

Boston Elevated Railway power station. 1902, ii-105.

Chicago water-works pumping station at Central Park Avenue. By F. A. Whitten, 1904, i-*488.

Discussion. By E. H. Foster, 1901, i-421; 1902, ii-495.

Locomotives using steam:

Pielock superheater on German 4-cylinder balanced compound locomotive. 1904, ii-*469.

Prussian State Railways. Built by A. Borsig. 1900, ii-*274.

Providence Engineering Works. 1902, i-374; 1904, i-27.

Results from the use of highly superheated steam in engines. By R. Lenke, 1901, ii-189.

Rice and Sargent engine with Schmidt superheater. Providence Engineering Works. Tests by A. C. Wood and D. S. Jacobus. 1904, i-27.

Schwoerer superheater. System of cast iron pipes with ribs inside and outside. 1900, ii-*107.

Steam turbines, Experiments with, by Mr. Lewicki of Dresden. 1902, i-318.

Stork superheater. Bent-pipe system. 1900, ii-107.

Sulzer engines, Steam consumption of. Tests at Munich by Prof. Schroeter. 1902, ii-259.

* denotes an illustrated article. † denotes an inset sheet.

Superheated steam and superheaters: (Continued.)

- Tandem-compound engine with poppet valves, European. 1902, i-*268.
- Tests of a compound engine using superheated steam. 1903, ii-516.
- Tests of Spring Creek pumping plant, Brooklyn, N. Y., showing economy of superheated steam. By John Primrose, 1904, i-301.
- Use of superheated steam in compound engines of large size. 1904, i-538.
- Support for water and gas service cocks and boxes, Flinn patent. 1904, i-*348.
- Supports for beams in tests of transverse strength. Ohio State University testing machine. By W. T. Magruder, 1900, i-*18.
- Surface condensers. (See Condensers.)

Surveying:

- Accurate geodetic work with a small transit. Test for C. L. Berger & Sons, Boston. 1901, i-122.
- Accurate measurement of angles with the engineer's transit. By P. D. Cunningham, 1901, i-*402.
- Alinement of New Croton aqueduct, Preliminary. By E. S. Gould, 1900, i-357, 394.
- Angle measurements, Accurate, with the engineer's transit. By P. D. Cunningham, 1901, i-*402.
- Angles of deflection, Rule for. 1900, i-26.
- Azimuth:
 - Should it be measured from the South? By W. G. Raymond, 1904, i-14, 37.
 - Use of true azimuths for the direction of land boundaries in the Hawaiian Islands. 1903, ii-519.
- Balancing and adjustment of compass survey notes. By Antonio Llano, 1900, i-42.
- Base line measurements for the 98th meridian triangulation. Use of iced bars. By J. F. Hayford, 1902, ii-*162, 168.
- Canal surveys. Planetable and transit methods in irrigation canal surveys. By C. E. Babb, 1902, i-353.
- Controlling a topographical survey. By W. C. Bunnell, 1901, i-115.
- Determination of latitude, longitude and solar time in reconnaissance surveys. By W. S. Post, 1900, i-138, 145.
- Disappearance of telescope cross-wires, Reason and remedy for. By J. C. L. Fish, 1900, i-312.
- Early works on surveying. 1900, i-239.
- Farm survey, Method of making. By G. B. Zahniser, 1900, i-*216, 226.
- Geodetic surveying. Accurate measurement of angles with the engineer's transit. By P. D. Cunningham, 1901, i-*402.
- Government stones. Descriptions of the regular marks upon corner and quarter-corner stones of the United States public land surveys. By W. Newbrough, 1904, i-302.
- Graduation of transit circles. By R. L. Sackett, 1900, i-57.
- Hammer-Fennel tachymeter. By Horace Andrews, 1903, ii-*138.
- Hints upon transit surveys and the avoidance and checking of errors. By E. T. Abbott, E. S. Gould, R. L. Sackett, 1900, i-2, 57, 146.
- Hydrographic surveys, Methods of making. By J. H. Bacon, W. M. Smith, 1903, i-*280, 326; By A. S. Cooper, J. P. Allen, 1904, i-*472, 589.
- Instructions for leveling. From Report of New York State Engineer and Surveyor. 1902, i-340, 437.
- Law of boundary surveys. Subdividing land below a meandered boundary. By W. E. Kern, F. Hodgman, 1902, ii-141, 170, 192, 214.
- Leveling. Standards of accuracy in spirit leveling. By C. E. Babb, William Harkness, 1902, i-340, 353, 437, 485.
- Note-book sketching in stadia surveys when platting is not done in the field. By R. G. Doerfling, 1901, i-*308.
- Obstruction to the line. An opportunity for diplomacy. 1901, ii-*124.
- Optical illusion. 1901, ii-*106.
- Plane table and transit methods in irrigation canal surveying. By C. E. Babb, 1902, i-353.

"1900, ii—112" means "Year, 1900, second volume, page 112."

Surveying: (Continued.)

- Plane table in topographic surveying. By W. P. Bullock, 1902, i-*438.
 Plane table for rapid stadia work, Use of. By J. W. Hays, 1902, i-207.
 Plane table surveying, Three-point problem in. By Antonio Llano, 1904, ii-*590.
 Refraction, Correcting sun's declination for. Simple method devised by Prof. Comstock, University of Wisconsin. 1900, i-366.
 Setting angle stakes in laying out roads. By M. M. O'Shaughnessy, E. M. Boggs, 1901, i-418, 449.
 Transit and stadia surveys, Methods of running. By Ernest McCullough, 1902, i-296.
 Triangulation for East River Bridge. By Oscar Erlandsen, 1902, i-*126.
 Underground water, Determining velocity of. Electrical method. By C. S. Slichter, 1902, i-*151.

(See also Grades; Leveling; Slope stake setting; names of instruments.)

Surveying instruments. (See their names.)**Surveys:**

- Boundary monument, Light weight metal. By F. M. Goodhue, 1904, ii-*522.
 Boundary surveys, Law of. By W. E. Kern, F. Hodgman, 1902, ii-141, 170, 192, 214.
 Cache River drainage survey. By A. H. Bell, 1904, i-115.
 Government section corners found out of place. By H. E. Lagergren, 1904, ii-576.
 Hartford, Conn., Bench marks, Book of. 1902, ii-373.
 Idaho-Montana boundary survey. Notes on monuments. A precarious transit station. 1901, i-*205.
 Magnetic surveys. By V. S. Hillyer, 1904, ii-176.
 Naval Hydrographic Office in controversy with the United States Coast Survey. 1900, i-344.
 New York City, Triangulation of, as a basis for topographical survey. 1903, i-456, 480.
 New York State. End of Adirondack Land Survey. Report of State Engineer E. A. Bond. Instructions for leveling. 1900, i-304; 1902, i-340, 353, 437, 485.
 Oswego-Mohawk canal. Methods and results of surveys and borings. General instructions to field parties. By D. J. Howell, 1900, i-*402, *418.
 Philippine Islands. Coast survey work. 1903, i-381.
 Primary triangulation and precise levels of the United States Government surveys. By H. M. Wilson, 1901, i-254.
 St. Clair Flats, Mich. Notes on the survey made by J. B. Davis of University of Michigan. 1902, i-49.
 Six-mile square township division, Origin of, in the United States Public Land surveys. 1904, i-468.
 Transcontinental triangulation along the 39th parallel. 1900, ii-96.
 Transcontinental triangulation and the American arc of the parallel. By J. E. McGrath, 1901, i-6.
 United States. Hydrographic and forest surveys. By H. M. Wilson, 1901, ii-20.
 United States Coast and Geodetic Survey. Historical summary since 1807. Details of the organization. 1900, i-377; 1902, i-266.
 United States Geological. Topographic mapping of the United States. Early history. Utility of surveys in engineering works. Cost and methods of work. Hydrography and hydrology as related to the work of the United States Geological Survey. Progress of the topographic mapping. By H. M. Wilson, 1901, i-*91, 254; By F. H. Newell, 1903, i-162, 301.
 United States and Mexican boundary. Report, dated Nov., 1896. 1900, ii-246.
 Yukon River, Alaska. Survey of mouths of river by United States Government. By G. R. Putnam and R. L. Faris, 1900, i-*370.

* denotes an illustrated article. † denotes an inset sheet.

- Surveys for electrolysis and their results. By D. H. Maury, 1903, ii-74.
- Suspended railway in Germany. Langen mono-rail suspended railway, $8\frac{1}{4}$ miles long. 1900, i-*218.
- Swamp drainage for the improvement of public water supplies. 1901, ii-477.
- Swamp excavation, Dredges for. By T. H. McCann, 1904, i-589.
- Swasey, Ambrose, Biographical sketch of. 1904, i-†89.
- Sweet, Elnathan, Biographical sketch of. 1903, i-*124.
- Sweet, W. A., Biographical sketch of. 1904, i-*144.
- Swimming tank, Concrete-expanded metal, in New York apartment house. 1902, ii-*17.
- Switch lock, Automatic. Invention of W. E. Emery. 1901, ii-*248.
- Switches, Electric:
- Automatic oil-switch for high-tension circuits, Westinghouse. 1903, i-*61, 80.
 - Electrically-operated high-tension switch, Metropolitan Traction Co., New York. By E. W. Rice, Jr., 1901, ii-*268.
 - Hand-operated enclosed air-tube type high-tension switch. By E. W. Rice, Jr., 1901, ii-*268.
 - High-tension currents. Discussion at Pacific Coast Electric Transmission Association. 1901, ii-236, *242.
 - Massena, N. Y., St. Lawrence Power Co. Notable electrical equipment. Electrical pneumatic switches. 1901, i-132.
 - Notes on switches. By F. A. C. Perrine, 1902, ii-135.
 - Oil-break switch electrically operated at Niagara Falls Power Co. By H. W. Buck, 1902, ii-*11.
 - Oil tank switch for high-tension currents. By E. W. Rice, Jr., 1901, ii-*269.
 - Pneumatically-operated high-tension switch for currents of 6,600 volts and 300 to 800 amperes. Metropolitan Traction Co., New York. By E. W. Rice, Jr., 1901, ii-*268.
 - Single-pole double-throw oil switch, direct current and alternating current. 1904, ii-*173.
 - Special form of open-air switch breaking a current of 25,000 volts and 60 amperes, Kalamazoo, Mich. By E. W. Rice, Jr., 1901, ii-*269.
 - Various forms for the control of high potential systems of large power. By E. W. Rice, Jr., 1901, ii-*267.
- Switches, Railway:
- Derail:
- Derail for side tracks, Hayes. 1904, i-*265.
 - Time lock to prevent derailments at interlocked grade crossings, Spicer invention. 1902, i-*210, 233.
 - Use of derail switches. Derailments and conclusions to be drawn therefrom. By W. H. Elliott, 1901, i-68.
 - Double slip switches, Connecting. By A. H. Rudd, 1900, i-*23.
 - Electric operation, Chicago Transfer & Clearing Co.'s switching yards. 1902, i-†12, 14.
 - Eliminating the turnout in computing track connections. By C. M. Kurtz, 1902, i-*276.
 - Facing points and slip switches. By A. H. Rudd, 1900, i-*23.
 - Split switch of new design, Weir Frog Co. 1901, i-161.
 - Standards in United States, Canada and Mexico. 1900, ii-142, 149.
 - Street railway switch. Improved tongue switch, Union Traction Co., Indiana. 1902, ii-*396.
- Switching yards. (See Railway yards.)
- Switzerland, Municipal notes in. 1904, i-*533.

T.

- Tables, Device for easy reading of. 1904, i-*331.
- Tachymeter, Hammer-Fennel. By Horace Andrews, 1903, ii-*138.
- Tackle-block, Tarbox. 1900, i-*52.
- Tacoma, Wash., Notes by an engineer. 1900, i-327.
- "1900, ii—112" means "Year, 1900, second volume, page 112."

Tamping machines:

- Electric machine on the Paris, Lyons & Med. Ry. 1904, i-*597.
- Track machine, Sheppard invention. 1900, ii-*404.

Tanks:

- Calibration of irregular vessels, Graphical method for. By Arnold Emch, 1903, i-*158.
- Concrete-steel tanks for acid liquor under pressure. By A. C. Arend, 1904, i-*384.
- (See also Bins; Water tanks.)

Tape handle and end marker. Making tape measurements with one man. By T. N. Badger, T. P. Perkins, 1904, ii-*92, 132, 242.

Tape reel, Surveyor's. 1902, ii-371.

Tapes. (See Chain tape; Steel tapes.)

Tapping a lake in France 60 feet below the water surface to increase the water supply. 1901, i-117.

Taps, Tool for removing broken. 1904, i-*23.

Tariff. United States export trade and tariff walls. Russia increases tariff rates on United States imports. 1901, i-49, 152, 168, 228.

Tarsney Act. (See Buildings, Government.)

Telegraphy:

- Fire-alarm, Wireless automatic. 1903, ii-89.
- Statistics of the world's submarine and land telegraphs. 1902, ii-181.
- Submarine telegraphs:
 - Pacific cable. 1902, ii-112, 437; 1903, ii-25.
 - Statistics of the world. 1902, ii-181.
- (See also Electrograph; Wireless telegraphy.)

Telephone cables:

- St. Gotthard tunnel. 1901, ii-*427.
- Span of 3,200 feet over Susquehanna River, Columbia, Pa. 1902, ii-149.
- Submarine cable on England-Belgium line. 1903, ii-*110.

Telephone tunnels. (See Subways.)

Telephonograph. 1900, ii-69.

Telephony:

- Berliner patent, Decision against. 1901, i-161, 168.
- Co-operative telephone system, Grand Rapids, Wis. 1901, i-124.
- Fence-wire telephone lines in Colorado. By W. P. Bullock, 1902, ii-450.
- Long-distance telephony. Proposed system by M. I. Pupin of Columbia University. By H. T. Wade, 1900, ii-133.
- Municipal telephone exchanges in England. Sale of Tunbridge Wells system. 1903, i-35.
- Ruhmer photo-telephony. 1903, ii-458.
- Strowger automatic telephone exchange system in Chicago. 1902, ii-239.
- Telephone in railway service. Telephoning from moving trains. Chicago & Northwestern R. R. 1902, i-285, 518, 520.
- Telephoning over telegraph wires, Illinois Central Ry. Tests. 1902, i-158.
- Train dispatching by telephone, Union Traction Co. of Indiana. 1902, ii-398.
- Wireless telephony, Notes on. 1902, i-41, 60.

Telescope cross-wires, Disappearance of, Reason and remedy for. By J. C. L. Fish, 1900, i-312.

Telescopes:

- Eccentricity in object glasses. By S. P. Baird, W. M. Cain, William Harkness, J. G. Gray, 1901, i-377, 433, 449, 470.
- Magnifying power, Determining. By William Nelson, H. Van Duzee, 1901, i-*169, *190.
- Water telescopes at Buffalo breakwater construction. 1901, i-*347.

Telpherage. (See Cableways, Electric.)

Temperatures, Underground, investigated 1899-1900, Germany. 1901, ii-*478.

Template for platting cross-sections. By J. M. Rudiger, 1904, i-*542.

Teredo navalis, Pine timber resists attacks of. By E. R. Smith, 1900, i-361.

Terminals. (See Railway terminals; Street railway terminal.)

* denotes an illustrated article. † denotes an inset sheet.

Terms in engineering literature. By Rudolph Hering. 1900, i-78; By H. M. Wilson, 1903, i-236.

Testing air motors and air hammers, Apparatus and methods for. Chicago, Burlington & Quincy R. R., Aurora, Ill. By M. H. Wickhorst, 1903, ii-517, *529.

Testing laboratories. (See Laboratories.)

Testing machines:

Ball thrust bearings tested, Case School, Cleveland, Ohio. By C. H. Benjamin, 1901, i-*403.

Brick testing machines, Rattler, at Purdue University. By W. K. Hatt and W. P. Turner, 1901, i-*3.

Car coupler testing machines, Master Car Builders' Association. 1900, i-*431.

Case, J. L., Threshing Machine Co. Physical and chemical laboratory. 1902, ii-*36.

Cement testing machines. By E. B. Kay, 1901, ii-*95.

Drop testing machines for cast iron car wheels. Barr drop. Master Car Builders' standard drop. By G. W. Beebe, 1900, ii-*266.

Impact testing machine, Purdue University. Iron and steel under impact in tension. By W. K. Hatt and W. P. Turner, 1901, i-*3, 9.

Oil testing machines. Friction tests of lubricating oils. By Albert Kingsbury, 1902, ii-*538.

Supports for beams in tests of transverse strength. Ohio State University. By W. T. Magruder, 1900, i-*18.

Tensile-impact machine, Purdue University. By W. K. Hatt, 1904, ii-*205.

Theaters:

Berne, Switzerland. "Stadt-theater." Concrete-steel construction. 1904, i-60, *69.

Chicago:

Fire Dec. 30, 1903. 1904, i-13, *21, *34.

Ordinance for fire protection. 1904, i-103.

Report of experts on condition of Chicago theaters. 1904, i-60, 65.

Thermometer-thermostat, Bristol. 1904, i-*514.

Thompson, Almon D., Biographical sketch of. 1900 i-46.

Thread-milling machine, Pratt & Whitney. 1903, i-15, *21.

Thurston, Robert Henry, Biographical sketch of. 1903, ii-*420.

Tide gates, Automatic, for the Bolsa Chica Gun Club, California. By J. D. Schuyler, 1904, i-*114.

Tide indicators, Electric. 1902, i-141.

Tides, Range of, in the Bay of Fundy. 1902, i-385.

Tie-hewing machine. Salem Iron Works, N. C. 1901, ii-55.

Tie-loading machine, Angier. Used at Sheridan, Wyo. Burlington & Missouri River R. R. 1902, ii-*222.

Tientsin, China, Trade of, and the control of the Peiho River. 1900, ii-185.

Tie plates:

Denver & Rio Grande Ry. Experience, 1901, ii-279.

Gage for setting tie plates on ties. Table showing actual time consumed in setting and embedding tie plates, Buf., Roch. & Pitts. Ry. 1900, ii-*81.

Report on, at Roadmasters' and Maintenance of Way Association. 1904, ii-263.

Standard tie-plates in United States, Canada and Mexico. 1900, ii-142, 430.

Tie plugs, Use of, in hard and soft wood ties. Report at Roadmasters' Association. 1900, ii-341.

Tie rods, Tests of small, model cement arches to determine value of. By D. B. Luten, 1900, i-*106, 112.

Ties:

Concrete-steel:

Harrell design. Experience with ties on the Chicago Terminal Division of the Penn. lines west of Pittsburgh. 1901, i-32, 339.

Increasing use of. 1903, ii-268.

Italian railway. By O. J. D. Hughes, 1902, ii-426.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Ties:

Concrete-steel: (Continued.)

Kimball design. Construction of ties. Weight and cost. Trial on Pere Marquette R. R. 1902, i-*268.

Kimball design modified, Pere Marquette R. R. 1902, ii-*148.

Notes. 1902, ii-223.

Ulster & Delaware Ry. 1904, ii-*305.

Voiron-St. Beron Ry. 1904, ii-*18.

Creosoted. (See Timber preservation.)

Discussion at Roadmasters' and Maintenance of Way Association. Wooden, metal and composition ties, tie plates and preservation of ties. 1902, ii-223.

Forests for producing railway ties to be established in Cape Colony, South Africa. 1902, ii-249.

Marking ties. 1900, i-197; 1902, ii-437.

Preservation. (See Timber preservation.)

Southern Pacific Ry. Tie preservation on Atlantic System. Burnetizing and creosoting. Tables giving records of ties treated and renewed. Specifications for creosote oil. 1900, ii-278.

Specifications. Report at American Railway Engineering and Maintenance of Way Association. 1904, i-285.

Standard ties in United States, Canada and Mexico. Table. 1900, ii-142, 149, 215, 430.

Steel:

Bessemer & Lake Erie R. R. Experience. 1903, ii-*421.

Chester tie. Huntingdon Broad Top Mountain R. R. Report of Franklin Institute. 1900, ii-*38; 1901, ii-55.

Comparison with wood, Mexican Southern Ry. Tie plantations in Mexico and South Africa. 1903, ii-223, *226.

Discussion at Roadmasters' Association. 1903, ii-463.

Lake Shore & Michigan Southern Ry. Experimental trial. Buhner pattern. Ties made from old rails. 1900, ii-390; 1901, i-359; 1902, i-230, *240.

Mexican Southern Ry. Experience. 1900, i-44.

Scranton, Pa., street railway. 1901, ii-*495.

Use of metal ties in United States and abroad. 1902, i-230.

Tamping machine. (See Tamping machines.)

Tamping ties. Gravel ballast, broken stone ballast and sand ballast. 1901, ii-279.

Tie renewals and timber supply. Endeavor to obtain statistics by American Railway Engineering and Maintenance of Way Association. 1901, ii-441.

Wear of spikes, Mechanical devices for preventing. 1904, i-263.

Wooden:

Discussion at Roadmasters' Association. 1903, ii-463.

Experience in Mexico and South Africa. Tie plantations. Comparison of steel and wooden ties. 1903, ii-223, *226.

(See also Spikes.)

Ties for concrete molds. (See Concrete molds.)

Tile, Track drainage. 1903, ii-361.

Timber:

Australian wood at the Paris Exposition. 1900, ii-66.

Classification and inspection rules for yellow pine lumber in Georgia and South Carolina. 1904, i-454.

Oak, Longevity, in Oregon. 1902, ii-65.

Oak, Resistance to decay. Old cannon on headland of the Golden Gate. By J. H. G. Wolf, 1902, i-*437, 520.

Properties of Douglas fir. 1904, ii-483.

Tensile tests of timber. Experience in Buenos Ayres. 1903, ii-77.

Tests of bridge timber 51 years old. By E. D. Graves, 1904, i-331.

* denotes an illustrated article. † denotes an inset sheet.

Timber: (Continued.)

Use of inferior timbers for structural purposes. By Herman Von Schrenk. 1904, ii-86.

(See also Forests and forestry.)

Timber joints. (See Joints.)

Timber preservation:

Alamogordo Lumber Co., Alamogordo, N. M. Wellhouse process. 1902, ii-*366.

Atchison, Topeka & Santa Fe Ry. Notes on chemical treatment of ties. 1900, ii-342.

Burnetizing process:

Carbondale, Ill., Ayer & Lord Tie Co., Grenada, Miss. Electric power for handling material. 1902, i-418.

Southern Pacific Ry. Ties. Process of treatment. Table giving records for 10 years. 1900, ii-278.

Creosoting process:

Houston & Texas Central Ry. Service of creosoted pine ties. 1900, i-401.

Improved methods. Experiments, Table showing comparative absorption of green and vulcanized pine railway ties. By F. A. Kummer, Jr., 1900, i-378.

Life of creosoted telegraph poles. By A. T. Kinsey, 1903, i-204.

Poles for electric line work. Augusta Railway & Electric Co., Ga. By W. E. Moore, 1902, i-433.

Southern Pacific Ry. Process of treating ties. Specifications for creosote oil. 1900, ii-279.

Ties, Creosoted, Use of, in United States. 1903, ii-328.

Discussion at American Railway Engineering and Maintenance of Way Association. Principal plants in United States. Methods of injecting chemicals. 1901, i-206; 1904, ii-378.

Discussion of subject. By O. Chanute, 1900, ii-79.

Ferrell process for preserving and fireproofing wood and textile fabrics. 1904, i-111.

Nodon-Bretonneau process, Use of electricity. 1900, i-359.

Pavement blocks of wood treated, Boston. 1901, ii-49.

Plants in the United States, Lists of. Methods of injecting chemicals. 1901, i-206; 1902, i-236; 1903, i-286; 1904, i-262.

Powell process. 1903, i-465; 1904, ii-473.

Progress in timber treatment. Report at American Railway Engineering and Maintenance of Way Association. 1904, i-263.

Review of what railways have done toward tie preservation. Report at American Railway Engineering and Maintenance of Way Association. 1902, i-235, 469.

Rueping and Giussani processes at St. Louis Exhibition. 1904, ii-433.

Specifications for treating ties with chloride of zinc and tar oil. Royal Prussian State Railway. By O. Chanute, 1900, ii-80.

Texas track experiments. 1904, i-262.

Thilmany process. Experience with ties. By E. Martin, 1900, i-326.

Vulcanizing timber. Invention of Mr. Powell, of Liverpool. 1903, i-465; 1904, ii-473.

Zinc creosote used by Chicago Tie Preserving Co. 1902, i-395.

Timbering, Cost of square-set, in mines, Rossland, B. C. By B. C. Yates, Bernard McDonald, 1902, ii-377, 502; 1903, i-14.

Time card, Team, on road construction. By H. P. Gillette, 1902, i-*261.

Time lock to prevent derailments at interlocked grade crossings. Inventor, V. K. Spicer. 1902, i-*210, 233.

Tipples:

Automatic mine car tipple. Phillips Mine Supply Co. 1903, i-*451.

Cardiff Coal Co., Cardiff, Ill. Steel tipple. By G. S. Rice, 1904, i-*576.

Southern Indiana Railway. Steel tipple. 1904, i-*190.

Virginia & Pittsburg Coal & Coke Co., Fairmont, W. Va. 1901, ii-*192.

"1900, ii-112" means "Year, 1900, second volume, page 112."

- Tires, Wide wagon, Chicago ordinance. 1903, ii-89.
(See also Roads.)
- Titanium, Influence of, on the properties of cast iron and steel. By A. J. Rossi, 1901, i-386.
- Titles on backs of books and pamphlets. 1903, ii-Eng. Lit. Sup., Dec. 10; 1904, i-Eng. Lit. Sup., Jan. 14.
- Ton-mile cost on the "Bessemer" road for 1903. 1904, i-310.
- Tonnage facilities by compact storage of cargoes, Importance of economizing. By H. P. Jones, 1901, i-150, 152.
- Tonnage rating. (See Train loads.)
- Tool, Definition of. 1904, i-Cons. News Sup., Mar. 10.
- Tools. (See Hydraulic tools; Machine tools; Pneumatic tools; Steam hammers.)
- Topophone, an instrument for locating sound. 1901, i-419.
- Tornadoes:
Birmingham, Ala., March 25, 1901. By Julian Kendrick, 1901, i-*246.
St. Paul, Minn., Aug. 20, 1904. By C. A. P. Turner, R. A. Tanner, L. W. Rundlett, 1904, ii-182, *192, 385.
Sanitary work after floods, fires and tornadoes. Report to New York Chamber of Commerce. By G. A. Soper, 1901, i-301.
Tenn., Miss. and Arkansas, Nov. 20, 1900. By S. C. Emery, 1901, i-134.
Wind force in tornadoes. 1902, i-7.
- Torpedo boats. (See Warships.)
- Torrey, Augustus, Biographical sketch of. 1902, ii-*171.
- Towers, Steel, for mounting derricks at the new Croton dam. 1904, ii-*308.
(See also Coal hoisting towers.)
- Tracing cloth, Cleaning, and restoring its glaze. 1900, i-161.
- Track:
Berlin Electric Rapid Transit Ry. Light rails. 1902, i-392, 403.
Center line, Practice in re-establishing and monumenting. By A. I. Frye, 1904, i-*351.
Central London Railway. Track construction of steel and concrete. 1900, i-*237.
Cincinnati Southern Railway. Roadbed and track. 1902, i-142.
Cost, Comparative, in Dec., 1898, and Dec., 1899. Compiled by Francis How. 1900, i-14.
Drainage of track. 1902, ii-221; 1903, ii-361, 362.
Grading for roadbed and yards. Report at American Railway Engineering and Maintenance of Way Association. 1901, i-199.
Guard rails. (See Guard rails.)
Ice, Removing with a steam shovel. By G. S. Meek, 1904, i-106.
Locating turnouts and frogs, Methods of. By C. M. Kurtz, 1904, ii-43, *177, *221.
Maintenance by contract. European railway practice. 1900, ii-95.
Maintenance of line and of surface. Vertical curves. Report at American Railway Engineering and Maintenance of Way Association. 1902, i-245.
Mexican Central Railway. Standard track construction. 75-lb rail compared with that of American Society of Civil Engineers. 1900, i-*264.
Needed improvements in railway track and maintenance of way. 1904, ii-219.
Noiseless construction for upper deck of double-deck tunnel on lower Broadway, New York City. By J. N. Reno, 1902, i-*175.
Plate-way track system, Notes on. 1901, ii-81.
Relation of track to maximum trains. By E. E. R. Tratman, 1902, i-337.
Repairs to track made under water, on the Vandalia Line. By H. I. Miller, 1903, ii-47.
- Roadbed:
Concrete construction for street railways. 1902, i-*188, 232; By B. J. Arnold, 1903, i-*191.

* denotes an illustrated article. † denotes an inset sheet.

Track:

Roadbed: (Continued.)

- Grading. Report at American Railway Engineering and Maintenance of Way Association. 1901, i-199.
- Oiled roadbeds in California. 1904, ii-501.
- Report at Convention of American Railway Engineering and Maintenance of Way Association. 1903, i-259, 280.
- Specification for the formation of the roadbed. 1903, i-259.
- Width. Discussion at American Railway Engineering and Maintenance of Way Association. 1901, i-214.
- Sand track and derails at crossings. 1902, i-214.
- Setting out track in yards. N. Y., N. H. & H. R. R. at Boston, Mich. Cent. R. R., Lehigh Valley Ry., Chic. Junction Ry., Penn. lines. 1901, i-232.
- Standards of track construction in the United States, Canada and Mexico. Tables. 1900, ii-142, 148, 215, 430.
- Steel longitudinals for railway track. S. E. Duff, inventor. 1904, i-406.
- Street railway:
- Concrete roadbed construction. Kansas City, Mo.; Buffalo, N. Y.; Detroit, Mich.; Toronto, Can.; Rochester, N. Y.; Indianapolis, Ind.; Denver, Colo.; Cincinnati, O.; Milwaukee, Wis. 1902, i-188, 232.
 - Conversion of track with girder rail into track with grooved head, Springfield, Mass. 1900, ii-448.
 - Foundations in Rochester, N. Y., and Chicago. 1902, ii-311; By B. J. Arnold, 1903, i-191.
 - St. Louis, Standard construction. 1904, i-620.
 - Seranton, Pa. Concrete base, T-rails, steel ties and reinforced joints with brick and asphalt paving. 1901, ii-495.
 - Union Traction Co. of Indiana. Concrete foundations. Improved tongue switches. 1902, ii-396.
- Turnouts, Locating. By C. M. Kurtz, A. L. Grandy, 1902, i-276, *371; By A. M. Haynes, 1904, i-589; By C. M. Kurtz, R. W. Stewart, 1904, ii-43, *177, *242.
- Wagon traffic on steel wheelways. (See Rails, Highway traffic.)
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- Track apprentice system of Illinois Central R. R. Experience of three years. 1900, i-157.
- Trackbarrow. (See Wheelbarrows.)
- Track bolts, Reversing alternate, in rail joints. 1900, ii-341.
- Track brake. (See Brakes, Track.)
- Track-breaking machine, St. Louis & Suburban Railway. 1902, ii-539.
- Track elevation:
- Chicago:
- Atchison, Topeka & Santa Fe Ry. 1900, i-19, 24.
 - Chicago & Alton Ry. 1900, i-19, 24; 1902, ii-181.
 - Chicago, Burlington & Quincy R. R. 1900, i-22, 24.
 - Chicago Junction Ry. 1900, i-122.
 - Chicago, Milwaukee & St. Paul Ry. 1900, i-122, 385.
 - Chicago & Northwestern Ry. 1900, i-20, 24, 122, 385; 1902, ii-181.
 - Chicago, Rock Island & Pacific Ry. 1900, i-132, 149.
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 - Pitts., Cin., Chic. & St. Louis Ry. 1900, i-125, 385.
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- Progress made. Extent of work done by several railways. Different methods of carrying on work. 1900, i-18, 24, *122, 125, 149, 385; 1901, i-89, 140; 1901, ii-321, 341; 1902, i-285; 1902, ii-1; 1904, i-24.
- St. Charles Air line. 1900, i-124.

"1900, ii-112" means "Year, 1900, second volume, page 112."

Track elevation: (Continued.)

Cincinnati, Ohio. Proposed elevation of tracks by various railways lines. Report by Committee to Board of Legislation. 1901, ii-23, 119, 171.

(See also Grade crossings.)

Track gages. (See Gages, Railway.)

Track inspection car on the Northern Railway of France. 1904, i-*290.

Track jacks. (See Jacks.)

Tracklaying:

Atchison, Topeka & Santa Fe Ry. Point Richmond extension. Rapid work. Track laid by hand. 1900, ii-320.

Kersey Railroad. By G. L. Woollard, 1900, ii-356.

Tracklaying machines:

Canadian Pacific Ry., Columbia & Western Line. 1900, i-386.

Early machines. 1902, ii-32.

Holman, on Canadian Pacific Ry. 1900, i-387.

Hurley, on Bessemer & Lake Erie R. R. By L. A. Wells, 1902, i-*322.

Roberts machine:

Canadian Pacific Ry. 1900, i-386.

Chicago & Northwestern Ry. 1900, ii-62.

St. Louis & San Francisco Ry. 1900, ii-9.

Steam shovel invented by W. B. Michel. 1904, ii-*103.

Track scales:

Chicago, Lake Shore & Eastern Ry. Gravity scale 100 feet long. By E. E. R. Tratman, 1900, ii-376.

Discussion by Railway Superintendents of Bridges and Buildings. 1900, ii-288.

Trackway. (See Rails, Highway traffic.)

Traction engines:

Practice and manufacture in the United States. Report of Edward H. Sanborn in the Census Bulletin. 1902, ii-234.

Siberia. Engines and steel wagons as substitute for canal trains. 1900, ii-241.

South Africa, for hauling coal from railways to mines. 1903, ii-153.

Traction increasers:

Atchison, Topeka & Santa Fe Ry. Applied to 75 engines of the Prairie type. 1902, i-331.

Chicago & Alton Ry., on passenger locomotives. 1903, i-*475.

Traction on wagon roads. (See Roads.)

Trade journalism, Disreputable. 1902, i-192.

Trade names, Property rights in. Legal decision. 1901, ii-330.

Trade publications, Systematic collection of. 1904, i-Eng. Lit. Sup., April 14, May 19.

Traffic. (See Railway traffic; Roads; Streets; Transportation.)

Trafford City, Pa. Westinghouse manufacturing plant and industrial town. 1902, ii-*302.

Train control:

Discussion. 1903, ii-231.

Electro-pneumatic. Multiple-unit system on Brooklyn elevated lines. 1903, i-45.

Multiple unit system to be tried on Metropolitan District Railway of London. 1903, i-397.

Train loads:

Changes in specified loadings in 8 years. By H. S. Jacoby, 1902, ii-43.

Chicago & Eastern Ill. R. R. Heavy freight train loads, year ending June 30, 1902. 1902, ii-168, 215.

Effect of long ruling grades on tonnage rating of locomotives. 1904, ii-447.

Equated tonnage rates for freight locomotives. Methods of test and calculation. By M. H. Wickhorst, 1903, i-354.

Increasing the revenue train-load by large capacity cars and improvements in car details. By F. F. Gaines, 1901, ii-40, 47.

* denotes an illustrated article. † denotes an inset sheet.

Train loads: (Continued.)

Lake Shore & Michigan Southern Railway. Large train loads and low freight rates for 1899. 1900, i-304.

Pittsburg & Lake Erie R. R. Average freight train load for year ending June 30, 1901, 758 tons. 1902, ii-215.

Ton-mile statistics. Report at American Railway Master Mechanics' Association. 1902, ii-22.

Tonnage method of locomotive rating, Penn. R. R. 1902, i-6.

Various railways, in tons, 1900-1903. By K. W. Blackwell, 1904, i-144.

(See also Locomotives, Hauling capacity.)

Train resistance:

Comparative diagram of train resistance curves representing various formulas. Tests on the C., B. & Q. R. R. By J. G. Crawford, William Harkness, 1901, ii-325, 368.

Experiments with electric cars for the General Electric Co. in 1900. By W. J. Davis, Jr., 1902, i-495.

German tests at Hanover, by Prof. Albert Frank. Coasting method. 1903, i-573.

Special rational formula. By J. B. Blood, 1903, ii-8.

Train resistance on curves. By L. B. Merriam, J. L. Campbell, 1901, ii-40, 74, 159.

Train speed. Cost of running trains at high speed. Tests on C., B. & Q. R. R., July, 1900. By J. G. Crawford, 1901, ii-174.

Trains:

Adams invention, Balt. & Ohio R. R. Vestibuled from end to end and sides extended nearly to track. Test. 1900, i-313.

Canadian Pacific Railway. Royal train used by Duke and Duchess of Cornwall and York. 1901, ii-*342.

Cost of running trains at high speed. By F. A. Delano, 1900, i-54; 1901, i-472.

Derailed train, Devices on truck, for protecting. 1904, i-375.

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Fast runs:

Balt. & Ohio R. R., Sept. 6, 1903. 1903, ii-213.

Canadian Pacific Ry, Montreal to Ottawa. 1900, ii-345.

Chicago & Northwestern Ry. Record of the "Chicago Special." 1903, i-322.

Lehigh Valley R. R. Fast runs of "Black Diamond" express. 1900, ii-295, 381.

London to Birmingham. Comparison of weights of English and American trains. 1902, ii-132, 168.

New York to Los Angeles in 73 hours 21 minutes. 1903, ii-153, 237.

N. Y. C. & H. R. R. R. 1902, ii-41; 1903, i-117, 288.

Penn. R. R. 1902, i-301, 381, 449.

Wabash R. R. 1902, i-405, 455.

High-speed trains and train service in Europe and America. Tables. 1904, i-103, 220.

Maximum trains: their relation to track, motive power and traffic. By E. E. R. Tratman, 1902, i-336.

100 miles an hour, German experiments. 1903, ii-268.

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Overhead travelers for erecting steel bridges. Report of Association of Railway Superintendents of Bridges and Buildings. 1904, ii-377.

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Utah Central Ry. Trestles with unusual features. By W. P. Hardesty, 1901, i-*46.

Weight of trestles. Formulas for calculating weights of steel trestles. By H. G. Tyrrell, 1900, ii-79.

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- Baraboo, Wis. Fever epidemic and its probable relation to the water supply. By W. G. Kirchoffer, 1902, i-*166.
- Butler, Pa. Expert investigation by Engineering News and the State Board of Health. By G. A. Soper, 1903, ii-542, 566, *574, 591; 1904, i-63, 64, 79, 467.
- Columbus, Ohio. Water supply. Causes of epidemic. Duties of river patrolmen. State Hospital for the Insane. By T. H. Eno, Allen Hazen, 1904, i-103, 129, *134, 178.
- Comparative statistics of some great epidemics of recent times. By G. A. Soper, 1904, i-64.
- Conneaut, Ohio. Fever due to alleged improper mechanical filtration. Report by B. H. Flynn of State Board of Health. 1902, i-278.
- Diagram showing mortality rate per 100,000 population in six cities. By C. A. Brown, 1904, i-285.
- Edgewood, Pa. Statistics, 1896-1903. 1904, i-189.
- Elmira, N. Y. Statistics, 1895-1900. By J. M. Caird, 1901, i-476.
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- Grand Forks, N. D. Epidemic of 1893-1894. By G. S. Williams, W. P. Mason, 1904, i-16, 23, 63, 106.
- Hiram, Ohio. 1901, i-169.
- Ithaca, N. Y. President Schurman's bulletin. Vote for municipal ownership of water-works. Work proposed. 1903, i-165, 205, 215, 289, 421; By G. A. Soper, 1904, ii-260.
- Kittanning, Pa., and cities near. 1904, i-126.
- Leadville, Colo., 1903-1904. Official report by C. E. Cooper. 1904, i-200, 208.
- Lorain, Ohio. Death rate for 1889-1892, 1903. By C. A. Brown, 1904, i-285.
- Lowell, Mass. 1903, ii-173; By George Bowers, 1904, i-125, 130.
- Marshalltown, Iowa. Report of State Board of Health. Lessons in sanitation. 1903, ii-162.
- Massachusetts. Average death rate, 1898-1900. 1904, i-219.
- Mendota, Wis., at State Hospital for Insane. 1904, ii-94.
- Michigan statistics, 1898-1902. 1903, ii-402.
- Minneapolis, Minn. Epidemic in East Minneapolis. By F. H. Bass, 1904, i-205, 407.
- Montreal. Resolutions adopted by Board of Health. 1904, i-358.
- New Haven, Conn. Review of epidemic. Bulletin of State Board of Health. 1901, i-257, 369, 376.
- New Jersey. Reduction in towns using water supplied by East Jersey Water Co. 1902, i-101.
- Outbreak in various places. 1904, i-24, 79, 199.
- Pennsylvania. Responsibility of state for water supply. Average death rate, 1898-1900. By J. H. Harlow, Benjamin Lee, 1904, i-16, 63, 219.
- Philadelphia. Effect of filtered water on typhoid fever. By A. C. Abbott, 1904, i-125, 130.
- Pittsburg. History of typhoid fever and of the water supply, 1890-1903. 1904, i-126, 176, 185.
- Prevention of typhoid fever. Popular misconceptions. 1904, i-77, 80, 104.
- Protection against, in contractor's camps. By C. R. Coutlee, 1904, i-227.
- Responsibility for controlling the spread of typhoid fever. 1904, i-60.
- Rock Island, Ill. Sewage polluted water supply. 1901, i-257.
- Soil and typhoid fever. By M. A. Veeder, 1902, ii-426.

* denotes an illustrated article. † denotes an inset sheet.

Typhoid fever: (Continued.)

- Special reports on typhoid fever and water supply, 1903 and 1904. 1904, i-125, 129.
- Suppression of, at its source. Extract from "Medical Record." Suggestions made by Dr. W. C. Daggett. 1904, ii-404.
- Swissvale, Pa., Statistics, 1902-1903. 1904, i-189.
- Transit of germs from Chicago to St. Louis. By J. L. Van Ornum, 1903, i-501.
- United States military camps during Spanish-American war of 1898. Report of Surgeon-General of the United States Army. 1901, i-193.
- Vital Statistics, deficiency in the registering of, 1904, i-104.
- Water purification:
 New York "Sun" on water filtration and typhoid fever. 1903, i-35.
 Relation to fever and cholera. 1900, i-92.
- Waterloo, Iowa. Report of experts on water supply. By G. J. Mack, 1904, i-126, 129, 302.
- Watertown, N. Y., 1904. By W. E. Fuller, 1904, i-204.
- Wilkesburg, Pa., Statistics, 1894-1903. 1904, i-187.
- Williams College, Williamstown, Mass. 1903, ii-490, 554.
- Zurich, Switzerland, 1880-1902. Effect of new filter plant upon death rate. By K. & R. Tanner, 1904, i-402.
- Tyrrell, H. G.:
 Credit for design of Connecticut River bridge at Middletown. By E. D. Graves, 1901, ii-158.
- Unauthorized publication of engineering drawings. By D. H. Andrews, H. G. Tyrrell, 1901, i-470.

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- Underground chambers, Moist-proof. Construction of dynamo room. By L. R. Grabill, 1900, ii-*166.
- Underground electric wires. (See Conduits; Subways.)
- Underground water. (See Water supply, Underground.)
- Union engineering building in New York:
 Mr. Carnegie's gift. 1903, i-408, 431, 434, 435, 439, 452, 455, 478, 480, 503, 512, 526, 540, 546, 549, 563, 567.
- American Society of Civil Engineers. Report of Board of Direction. Various opinions. Society declines to accept the offer. 1903, ii-8, 101, 454, 509, 602; By S. Whinery, E. H. Warner, H. S. Hains, L. L. Tribus, F. S. Odell, R. P. Bolton, Alexander Potter, G. W. Colles, G. B. Francis, E. S. Gould, F. S. Williamson, 1904, i-70, 74, 80, 83, 84, 109, 132, 154, 155, 225.
- Architectural competition. 1904, i-375, 467.
- Boston opinions, members of American Society of Civil Engineers. 1904, i-161.
- Business aspects. Questions of finance. Letters from J. A. Fulton, W. H. Breithaupt, Alexander Potter, S. Whinery, Emmet Steece, C. F. Loweth, C. H. Snow, Oberlin Smith, E. B. Van Winkle, W. D. Pickett, Fred. Brooks, 1904, i-132, 133, 181, 182.
- Gift raised by Mr. Carnegie to one and one-half million dollars. 1904, i-72, 80, 83, 255.
- Library. If not an American engineering building, why not an American engineering library? 1904, i-225.
- San Francisco opinions. By C. D. Marx, 1904, i-131.
- Washington opinions, members of the American Society of Civil Engineers. By H. M. Wilson, 1904, i-131.
- United States Geological Survey, Proximity of some of its monographs. 1903, i-151.
- United States Reclamation Service. (See Irrigation; Land reclamation.)
 "1900, ii—112" means "Year, 1900, second volume, page 112."

United States Steel Corporation:

- Benefits to consumers of low costs of production. 1901, i-305, 320.
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- Financiering methods. 1902, ii-32; 1903, i-234.
- Formation of company. 1901, i-120, 145, 168, 241, 250.
- How the formation of the trust brought about the result it was intended to prevent. 1902, ii-424.
- Relations between the Corporation and its employees. 1901, i-264, 306.
- Statistics of iron and steel production. 1902, i-456; 1902, ii-212.
- "United States Trade Reports," and its methods. 1902, i-192; 1904, ii-313.
- Unloading machines. (See Coal handling; Iron, Ore handling.)
- Unloading rails from work trains. Pneumatic device. Buffalo, Rochester & Pittsburgh Ry. 1903, ii-*325.
- Uralite, a new fireproofing material, manufactured in England. 1902, ii-174.
- Utah Lake. Utilization of the lake as a reservoir. By W. P. Hardesty, 1903, i-*442.

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- Air relief valves for pipe lines. Combined float and poppet valve, invented by A. S. Tuttle. 1903, ii-*169.
- Air valve for regulating the time of passing through an air lock, used in Kiel, Germany, dry dock construction. 1904, i-60, *65.
- Automatic valve for cutting out the meter on a factory fire service. Tilden invention. 1903, ii-*418.
- Bennett valve on air compressor of Lane & Bodley. 1901, i-*405.
- Boiler blow-off valve. Lunkenheimer Co. 1901, ii-*460.
- Buckeye engines with cut-off adjustable by hand. 1901, ii-*96, 368.
- Central-valve steam engine, American Bullock Mfg. Co. By E. T. Adams, 1900, ii-*386.
- Dual valve designed to make possible, under pressure, all repairs or renewals. 1902, ii-*148.
- Gate valves:
 - Double revolving gate disks. Darling Pump & Mfg. Co. 1901, i-*324.
 - 6-foot valve for Chicago water-works, Placing of. 1903, i-*575.
 - 8-inch hydraulic valve on Detroit water main supplying River Rouge, Mich. By G. H. Fenkell, 1902, i-*306.
- Hydraulic operation, Schneider steam engine. 1900, ii-*107.
- Hydraulic relief valves for water-wheel penstocks. Lombard Governor Co. 1904, ii-*422.
- Inlet valves and their relation to the efficiency and volumetric capacity of air compressors. By F. B. Gorey, 1901, i-390.
- Lang valve gear. 1900, i-*118.
- Naylor arrangement for operating steam and exhaust valves by electromagnets. 1901, ii-458.
- Pipe valves. Check valves with manholes for 36-inch pipe line, Washington, D. C. Michigan Brass & Iron Co. 1900, i-*71.
- Piston valves, Application of, to locomotives. By W. M. Smith, 1902, ii-*149.
- Poppet cylinder valves, 2,500-HP. engine, Paris Exposition. Dash pots of Collman gear. 1900, i-*405.
- Poppet valves, European practice, Paris Exposition. 1900, ii-106.
- Press-controlling valve, Manufacture of. American Pulley Co.'s all-steel pulley rims. 1901, i-423.
- Reducing valve on French steam car. 1904, ii-*79.
- 6,000-HP. engine for rolling mill. High speed valve gear. Quick-closing stop valve of peculiar design for use in reversing engine. 1902, ii-*139.

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Water meter testing apparatus, Baltimore, Md. By R. L. Clemmitt, 1902, ii-*357.

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Architect's Plaint. By F. M. Small, 1903, i-432.

Meest' McDonough's Blas'. By Henry Manley, Jr., 1902, ii-451, 543.

Old Oaken Bucket. By Dr. J. C. Bayles, 1901, ii-493.

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Golden Gate, Yellowstone Park. Effect of clay and loam on cement mortar. Tests, 1902-1903. By C. E. Sherman, 1903, ii-*443.

Santa Ana River, near Riverside, Cal. San Pedro, Los Angeles & Salt Lake R. R. By A. C. Ostrom, 1903, ii-*353, 364.

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Failure of steel viaducts, Minneapolis, Minn. 1903, i-*575; By E. F. Pabody, 1903, ii-37.

Gokteik viaduct, Burmah railways. Pennsylvania Steel Co., Builders, 1901, i-†147.

Guayaquil & Quito Ry. Construction details. By J. A. Harman, 1904, ii-*118.

High railway viaducts, Dimensions of notable. 1901, i-415.

Long Island R. R., Atlantic Ave., Brooklyn, improvements. 1902, i-*421.

New York Rapid Transit Ry. 1903, i-*181; 1903, ii-*199, 202, 246.

Oregon Short Line R. R. Steel. By W. P. Hardesty, 1903, ii-*329.

Paderno, over river Adda, Northern Italy. Wrought-iron arch. 1903, i-*545.

Painesville viaduct, Lake Shore & Michigan Southern Ry. By A. W. Buel, 1902, i-*364.

Paris Metropolitan Underground Railway, part of "North Circle." 1903, ii-*194.

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Piney Branch, Washington, D. C. Structural features. By T. C. J. Bailly, 1900, i-*334.

Pitts., Bess. & Lake Erie R. R. Construction details. Special steel through traveler. 1900, ii-†102.

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Starucca viaduct, Erie R. R. By A. W. Buel, 1902, i-*364.

Subaqueous:

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Ford's design. Reference to Fitzpatrick's design. By J. F. Ford, 1900, ii-410.

Thames River, London. Waterloo & Whitehall Ry. Scheme of 1867. Begun, but never finished. By F. E. Robertson, 1901, i-321.

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Uganda Ry., East Africa. Experience in the erection of American viaducts. By A. B. Lueder, 1904, i-*345.

Union R. R. Construction details. Tracks at different levels. Fireproof floors on the hot metal routes. 1900, ii-†103.

Viaur, France:

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Volcanic eruptions in the West Indies, 1902. 1902, i-381, 392, 405; 1902, ii-157, 201, 437.

Voltages, Composition and resolution of. Discussion at American Electrochemical Society. 1904, i-349.

Votometer, Bardwell. 1901, i-422.

Vreeland, H. H., Address at American Street Railway Association convention at Detroit, Oct., 1902. Criticism of Detroit "Free Press." 1902, ii-315, 323, 336.

Vulcan Iron Works Co. Rule for employees belonging to militia organizations. 1904, i-178.

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Street sprinkling wagon, Specifications, New York City. 1902, ii-94.

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Wall, Phoenix hollow tile. Estimated cost. 1903, ii-*421.

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"Illinois." Official speed trial. 1901, i-441.

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- "New Jersey" launched. 1904, ii-454.
- "Ohio" launched. 1901, i-369.
- "Oregon," Damage to, in Miau-Tau Straits. Repairs made at Puget Sound Navy Yard. 1900, ii-189; 1902, i-*206.
- "Rhode Island." Notes on design. By Philip Hichborn, 1901, i-†165.
- "Virginia." Notes on design. By Philip Hichborn, 1901, i-†165; 1904, i-327.
- "Virginia" type recommended by board of naval experts. 1901, i-425.

Boilers. (See Marine boilers.)

Central passageway proposed for intercommunication and piping. By G. W. Dickie, 1904, ii-*477.

Classification of naval vessels. 1901, ii-1.

Coal consumption, Methods of estimating. By D. W. Taylor, 1904, ii-38.

Coal consumption, steaming radius and the most economical speed of steam vessels. Report by M. E. Cooley. 1900, ii-263.

Competition between high explosives and armored vessels in naval warfare. 1904, i-424.

Crankshafts, Designs of. Report on naval boilers, by the British Admiralty committee. 1902, ii-*179.

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Design of cruisers. By Philip Hichborn, 1901, i-*166.

"Des Moines" launched. 1902, ii-225.

"Maryland" launched. 1903, ii-256.

"West Virginia" launched. 1903, i-381.

"Yosemite." Coal consumption, steaming radius and the most economical speed of steam vessels. 1900, ii-263.

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"Variag." Performance during 12-hour trial trip. Table comparing "Variag" with American and English cruisers. By C. H. Cramp, 1900, ii-362.

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- "Turbinia," at Paris Exposition. 1900, ii-*106.

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Waste for packing car journal-boxes, Tests of. By T. H. Symington, 1901, i-399.

Wastes, City, Disposal of. 1900, i-76, 401.

Wastes and by-products, Census Bulletin on the utilization of. Paper written by Henry C. Kittredge of Boston. 1902, ii-64.

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Elmira, N. Y. By J. M. Caird, 1901, i-475.

England, River Severn. Investigation by the Royal Commission. 1903, i-170.

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Far Rockaway, N. Y. Analyses before and after filtration. 1901, i-239.

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* denotes an illustrated article. † denotes an inset sheet.

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Vincennes, Ind. Analyses of river water before and after filtration. 1900, i-293.

Chicago & Northwestern Ry. Purifying water for locomotive boilers. By G. M. Davidson, 1903, i-296.

Collection of chemical and bacterial analyses by the Geological Survey. 1902, ii-48.

Columbus, Ohio. Chemical and bacterial analyses. 1904, i-137.

Field analyses. System devised by United States Geological Survey. 1903, i-381.

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Marlborough Brook, Mass. 1900. By W. W. Patch, 1903, i-342.

Microscopical analysis, Brooklyn, N. Y. By G. C. Whipple, 1900, i-383.

Rapid process devised by Messrs. Pignet and Hue with special reference to its use by marching troops. 1902, ii-93.

St. Louis, Mo., Mississippi River. 1902, i-197; By E. E. Wall, 1904, ii-381.

Scioto River, Ohio, from Dry Run sewer and from laboratory tap. By F. H. Eno, 1904, i-137.

Standard methods. Report to American Public Health Association, Oct., 1900. 1900, ii-301.

Vermont. State examination of water supplies. 1900, i-160.

Zurich, Switzerland. Diagram showing chemical and bacteriological analysis before and after filtration. By K. & R. Tanner, 1904, i-402.

Water closets:

First closets west of the Alleghany Mountains. By B. H. Flynn, 1902, ii-315.

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Chicago. Statistics, 1854-1900. 1901, ii-97.

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Effect of water meters in over 100 cities of the United States. Tables compiled from special official reports. By H. C. Hodgkins, S. J. Rosamond, G. I. Bailey, Clemens Herschel, 1901, i-279, 285, 477, 478.

Fall River, Mass. 1902, ii-517.

Lowell, Mass. 1890 and 1902 compared. 1903, i-275.

Lynn, Mass. 1902, ii-517.

Massachusetts. Report of State Board of Health for 1900. 1902, ii-414, 450.

Milwaukee, Wis. Use of meters and consumption compared with Philadelphia. Diagram. 1900, i-351.

Mount Vernon, N. Y., 1895-1900. 1901, i-394.

New Bedford, Mass., 1901. 1902, ii-518.

New York, Greater, 1900. 1901, ii-49.

Philadelphia, Pa. 1900, i-351; 1901, ii-81; 1902, ii-518.

Providence, R. I. Meter experience. By J. H. Shedd, 1903, ii-452, 454.

Required amount of water for a public supply, illustrated by experience at Providence, R. I. By J. H. Shedd, 1903, ii-452, 454.

United States, in various towns, as determined by meter measurement. 1903, i-41.

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Water curtains for fire protection in Chicago. 1904, i-128.

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"1900, ii-112" means "Year, 1900, second volume, page 112."

Water distilling plants:

- Distilling ship "Edgewater." British, American-built. 1902, ii-*99.
- Dry Tortugas, Florida. Test of plant. Lillie multiple effect evaporators. 1900, i-*203, 226.
- Series distilling apparatus of high efficiency. By W. F. M. Goss, 1903, ii-543, *547.
- Water distilling apparatus, Sextuple effect, for Egyptian government. 1904, i-303.

Water diversion:

- Compensation reservoirs in lieu of damages for water diversion permissible in Great Britain, but not in the United States. 1900, i-242.
- Diversion of interstate waters. Decision by United States Circuit Court of Appeals. 1901, ii-369.
- Freeport Creek, L. I. Suits against diversion of underground water. 1900, i-265.
- Newton, N. J. Mill owner's suit to collect damages. Judge Dixon's opinion. By L. L. Tribus, 1900, i-228; 1901, i-418.
- Norwich, Conn. Compensating mill owners by supplying them with stored water in time of drouth. Report of engineers. By Hill, Quick and Allen, L. L. Tribus, 1901, i-381, 418.

Waterfall pulsations, Ogdensburg, N. Y. By F. C. Shenehon, 1901, i-377.**Waterhammer. Experiments at Moscow water-works. 1900, ii-80; 1904, i-569.****Water hoisting in the Pennsylvania anthracite region, Methods and cost of. By R. V. Norris, 1903, i-*315; 1904, i-*208.****Water meter boxes:**

- Cast iron. By E. H. Cowan, 1904, i-*275.
- Vitrified pipe with cast iron cover, Cleveland, Ohio. 1903, ii-*373.

Water meter testing plant of National Meter Co. Test of 30-in. Premier meter. By A. S. Tuttle, 1904, i-*569.**Water meters:**

- Attitude of engineers toward water meters. Report to city of London, Ontario, favoring meters. By F. C. Coffin, W. H. Herschel, 1904, i-104, 130, 179.
- Bacteria in meters. 1902, i-252.
- Baltimore, Md. Testing, inspection, quarterly reading and general management of the system. Office records. Meter specifications for 1902. By R. L. Clemmitt, 1902, ii-*355.
- Battle Creek, Mich. Report on meters. 1904, i-375.
- Birmingham, Ala. Plan of company to introduce meters. 1902, ii-96.
- Brooklyn, N. Y. Waste of water through a $\frac{3}{8}$ -inch tap. Views of Mr. Hawkes, Superintendent of Water Distribution and Repairs. 1900, ii-128.
- Chicago. Meters recommended by City Engineer. Report on water waste by John Ericson, Nov. 13, 1902. 1902, i-101; 1903, i-41.
- Cleveland, Ohio:
 - Ordinance passed for metering of all consumers. Bids. 1901, ii-169, 264, 341, 410, 465.
 - Adoption of meters. 1902, i-165.
 - Experience with meters. 1902, ii-518; 1903, ii-278.
 - Methods and costs of installing meters. 1903, ii-*373.
 - Details of system. Freezing of meters. Costs of setting. Costs of operation. By E. W. Bemis, 1904, i-*579.
- Columbus, Ohio. Universal meter system recommended by Director of Public Improvements. Bids. 1902, i-61, 68, 141, 181.
- Cost of water and water waste. Water consumption per tap in 12 metered and 3 unmetered cities. By A. L. Holmes, 1902, i-109.
- Effect of meters on water consumption in the larger cities of the United States. Tables compiled from special official reports. By S. J. Rosamond, G. I. Bailey, Clemens Herschel, H. C. Hodgkins, 1901, i-279, 285, 477, 478.

* denotes an illustrated article. † denotes an inset sheet.

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- Electrolysis. Meter which "electrocuted" itself described by A. A. Knudson. 1903, i-397.
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- Fort Worth, Texas. Proposed meters for all consumers. 1901, ii-65, 169.
- Gages for use with Venturi meter. Devised by Henry Metcalfe, Cold Spring, N. Y. By C. P. Paulding, L. M. Hoskins, M. M. y Rivera, 1901, i-*148, 322.
- Halifax, Nova Scotia. Great need of meters to prevent water waste. 1900, ii-205.
- Hartford, Conn. Full meter system recommended by special committee. 1900, i-265.
- Jersey City, N. J. Universal meter system recommended. 1900, i-119.
- Knoxville, Tenn. Tests of 6-inch meters. 1903, ii-238, 245.
- London, Ontario. Report to city favoring meters. By F. C. Coffin, W. H. Herschel, 1904, i-104, 130, 179.
- Lowell, Mass. Notes. 1902, ii-517.
- Massachusetts:
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 - Relation between quantity of water passed through meters and total quantity of water pumped in 1900. 1902, ii-414, 450, 476.
- Melrose, Mass. Mr. Hunter does not favor meters. Meter nearly filled with rust and deposit. 1902, ii-*518.
- Merrimac, Mass. Regulations for the universal water meter system. 1904, ii-406.
- Metropolitan Water-Works of Boston. Measurement of flow in Sudbury and Cochituate aqueducts. By W. W. Patch, 1902, i-*488.
- Milwaukee, Wis. Use of meters and water consumption compared with that of Philadelphia. 1900, i-351.
- Nashville, Tenn. Agitation of subject. 1902, ii-64, 80.
- New York:
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 - Some house meter records. By A. S. Tuttle, 1903, ii-601.
- Norfolk, Va. Need of meters. 1903, i-276.
- Oberlin, Ohio. Notes on use of meters. 1900, ii-371.
- Philadelphia:
- Newspaper opposition to introduction of meters. 1902, i-458.
 - Use of meters and water consumption compared with that of Milwaukee, Wis. 1900, i-351.
- Premier 30-inch meter. Tests at plant of National Meter Co. Testing plant. By A. S. Tuttle, 1904, i-*473, *569.
- Providence, R. I., Experience at. By J. H. Shedd, 1903, ii-452, 454.
- Rust and deposit in Melrose, Mass. 1902, ii-*518.
- Sanitary benefits which result from the use of meters. By M. N. Baker, 1901, ii-275.
- Saratoga Springs, N. Y. Effect upon water waste and sewage purification. 1900, i-144, 176.
- Specifications at Baltimore, Md., 1902. 1902, ii-356.
- Springfield, Ill. Universal meter system adopted. 1902, ii-249.
- Springfield, Mass. Need of meters to prevent water waste. 1900, i-128.
- Testing room, Baltimore, Md., water department. Special valve to regulate flow of water. By R. L. Clemmitt, 1902, ii-*356.
- Tests of large meters at Lowell, Mass., Oct., 1904. 1904, ii-386.
- Typhoid fever germs in meters. Fears at Cleveland, Ohio, and Rochester, N. Y. 1903, i-300.
- Venturi meter used by Metropolitan Water Supply. 1903, i-88.
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Boston water-works. Seven mysterious breaks in 48-inch pipe line between Chestnut Hill and Brookline reservoirs. By F. I. Winslow, 1902, ii-24.

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Flattening of large cast iron pipes under earth pressure. By W. W. Patch, 1904, ii-*547.

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Pike's Peak Power Co., Colorado. Wood stave pipe line 23,000 feet long. By W. P. Hardesty, 1903, i-*3.

Southern California Mountain Water Co. 1904, i-*336.

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Fitchburg, Mass. Suit for pollution of Nashua River. 1900, ii-257.

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Mill Creek, Ohio. Sanitary survey of Mill Creek Valley, at and near Cincinnati, Ohio. 1903, i-154.

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- New Britain, Conn. Sewage pollution suits. 1900, ii-241, 345.
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- Pennsylvania. Responsibility of state. By J. H. Harlow, 1904, i-16.
- Protection of surface water supplies. 1901, ii-216, 224, 431.
- Red Bank, N. J. Pollution of Navesink River. 1900, ii-241, 350.
- Report of Committee of American Public Health Association on pollution of public supplies in the United States. 1900, ii-285, 295.
- Scioto River, Ohio, and typhoid fever. Duties of river patrolmen. By F. H. Eno, 1904, i-129, *134.
- Stream pollution and its pecuniary damage to natural water resources. 1902, ii-260.
- United States. Tabulated summary of water pollution in places of 3,000 population and upward. 1902, i-275.
- Washington, Pa. Legal decision. 1901, i-345.
- Waterbury, Conn. Supreme Court decision. 1900, i-33.
- Wisconsin. Supreme Court decision. 1901, i-288.

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- Cost of water power. By J. W. Thurso, 1903, i-30.
- Des Moines rapids, Project of developing the water power of. Extracts from report of Mr. Lyman E. Cooley. 1901, ii-366, 373.
- Efficient high-pressure plant of Edison Electric Co., in Southern California. By G. J. Henry, Jr., J. N. Le Conte, 1903, ii-*311.
- French legislation on the utilization of water for power. By Charles Pinat, 1902, ii-90.
- "Harness" of a water power, Chicago. 1902, i-153, 332.
- Joliet, Ill. Rival projects. Sanitary District of Chicago and the Gaylord Syndicate. 1902, ii-121, 172, 389.
- Kern River Co., Los Angeles, Cal. Electric power transmission 120 miles. Head-works and canal. By Burr Bassell, 1904, ii-*55.
- Massena, N. Y., St. Lawrence Power Co. Details of plant. Financial failure. 1901, i-*130; 1902, i-274.
- Modern turbine practice and water power development. By J. W. Thurso, 1903, i-26.
- Montgomery, Ala. Large electrical plant. 1901, ii-*418.
- New England:
- Influence of electricity on the development of water powers. By F. A. C. Perrine, A. M. Swain, 1903, ii-412, 415, 480, 569.
 - Value of New England water power. 1900, i-49.
- Nomenclature, Uniform, for hydraulic engineering. By J. W. Thurso, 1903, i-30.

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- Puget Sound Power Co., Puyallup River development. Electric power transmission plant. 1904, ii-*271.
- Sault Ste. Marie, Mich. Water-power plant of Michigan-Lake Superior Power Co. 1902, ii-*226, 294.
- Snoqualmie Falls, Wash. Details of water power plant and transmission system. 1900, ii-†398.
- Snoqualmie Falls & White River Power Co.'s plan. 1902, ii-477.
- Value of water-power. An analysis of the "commercial" value of water power per horse-power per annum. By A. F. Nagle, 1903, i-83.
- Vauvry, Switzerland. Water power electric plant and transmission lines. 1902, ii-*438.

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- Construction of moisture-proof underground chambers. By L. R. Grabill, 1900, ii-*166.
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- Operation of the water settling and filtration plant for 319 days. Table, weekly summary. Cost of filtration at Albany and Lawrence, Mass., compared. 1900, ii-88, 149, 165.
- Operation of slow sand filtration plant to the close of 1900. By G. I. Bailey, 1901, i-463.
- Slow sand filtration. Results of operation. Details of plant. Bacterial results. Reduction in death rates. Detailed costs. 1900, i-*31; 1901, ii-427, 428.
- Slow sand filtration. Costs. Compared with Lawrence, Mass., and Mount Vernon, N. Y. 1901, i-396.
- Alexandria, Egypt. Mechanical filtration experiments. 1903, ii-422.
- Allegheny, Pa. Filter crib. 1900, i-*328.
- Altona, Germany. Slow sand filtration. 1900, i-94.
- Anderson process at Choisy le Roi, Paris, Dordrecht, Antwerp and Amsterdam. Discussion of Dr. Weyl's paper before German Society. 1900, i-92.
- Antwerp, Belgium. Rusting-tank for producing a coagulant. 1904, ii-266.
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- Bartlesville, I. T. Coagulation, sedimentation and upward filtration of water. 1904, ii-*212.
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Cleveland, Ohio. Purification advised by special committee. 1904, i-50.

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East Providence, R. I. Removal by mechanical filtration. By E. B.

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Columbus, Ohio. Plans for new works and purification plant. 1901, i-273.

Comparative merits of spring and filtered water. Paris dual supply.

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Conneaut, Ohio. Alleged improper mechanical filtration cause of typhoid fever. Report of B. H. Flynn of State Board of Health. 1902, i-278.

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London experiments with copper. 1904, ii-488.

Report of Department of Agriculture, by G. T. Moore and K. F. Kellerman, on copper sulphate treatment of water for algæ growth. 1904, i-375, 493, 496.

Cornell University. Mechanical filter plant gives satisfactory analytical results. 1903, ii-352.

Danville, Ill. Mechanical filtration plant. 1904, i-*397.

Denver, Colo., Denver Union Water Co. Sedimentation tanks with numerous circular overflow weirs. Tests. 1900, ii-*322.

East Providence, R. I. Mechanical filtration. Bacterial analyses. Cost of operating filters. By E. B. Weston, 1900, ii-265; 1901, ii-434, 469.

Elmira, N. Y. Mechanical filtration. Efficiency of filters. By J. M. Caird, 1901, i-475.

Far Rockaway, N. Y. Iron removal from ground water by aeration and slow sand filtration. 1900, i-238.

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Gothenburg, Sweden. Artificial underground supply developed by Gustaf Richert. 1902, i-*32, 35.

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Hartford, Conn. Small supplementary plant proposed. 1903, i-289.

Hudson, N. Y. Slow sand filters, Operation and cost. By H. K. Bishop, 1902, ii-*111.

Indianapolis, Ind. Sand filtration proposed. 1903, i-77.

Iron, Removal of, Superior, Wis. Covered filter beds, aerator and clear water reservoir. Pumping station. Costs. By R. D. Chase, 1901, i-*141.

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- Iron removal from ground water by slow sand filtration, Far Rockaway, N. Y. 1900, i-†238.
- Kansas City, Mo. Reinforcement of walls of settling basins and use of coagulant to aid clarification. By W. Kiersted, 1900, i-†3.
- Lawrence, Mass.:
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- Lexington, Ky. 1902, ii-260.
- Little Falls, N. J., East Jersey Water Co. Mechanical filter plant and its operation. By G. W. Fuller, 1901, i-336, *340; 1903, i-*351.
- Locomotive boilers:
 Chicago & Northwestern Ry. Analyses of waters used. Boiler compounds. Purifying apparatus. Practical results from the use of hard and soft water. By G. M. Davidson, 1903, i-*296.
 Notes on treatment of water. By G. R. Henderson, 1903, ii-279.
- London, England. Slow sand filtration and cholera. 1900, i-93.
- Louisville, Ky. Mechanical filtration system developed by Charles Hermany. Purification through the processes of subsidence, coagulation and filtration. Estimated costs. 1901, i-*52, 73, 201, 336.
- Mechanical filtration:
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 Sand agitator at Louisville, Ky. 1901, i-*52.
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 (See also Bartlesville, I. T.; Danville, Ill.; East Providence, R. I.; Elmira, N. Y.; Little Falls, N. Y.; Louisville, Ky.; Norfolk, Va.; Philadelphia; Providence, R. I.; Vincennes, Ind.; Washington, D. C.; Winchester, Ky.)
- Metropolitan water supply for Boston and vicinity. Construction and operation of beds at Marlborough. 1900, ii-153; By W. W. Patch, 1903, i-*340.
- Minneapolis, Minn. Filtration plant recommended. 1904, ii-258.
- Mount Vernon, N. Y. Slow sand filtration plant. Six years' experience. 1901, i-294, 296; 1902, ii-*200.
- New Orleans, La. Plant for investigating the purification of Mississippi River water. R. S. Weston, resident expert. Details of plant. 1900, ii-241; 1901, i-17, *98.
- New York City. Commissioner Dalton's ideas on water filtration. 1900, ii-128, 148.
- Norfolk, Va. Mechanical filtration. Details of filters and operation of plant. Regulators. Water analyses. Coagulation. 1900, i-*346.
- Ozone treatment:
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- Ozone treatment vs. slow sand filtration. Discussion of paper by Dr. Weyl before German Society of Gas and Water-Works Engineers. 1900, i-92, 96, 130.

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Richmond, Va., James River water. Physical and bacteriological characteristics with reference to clarification methods. 1900, i-351.

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Filtration. Plan proposed by Edward Flad. Municipal ordinance submitted to Board of Public Improvements. 1902, ii-8.

Experience with sedimentation basins. 1903, ii-69.

Coagulation plant at the settling basins. Construction and operation. By E. E. Wall, 1904, ii-*379.

(See also Water supply, St. Louis, Mo.)

Sand washers at Marlborough Brook, Mass. By W. W. Patch, 1903, i-*341.

Sedimentation. (See below, Subsidence.)

Sheffield, England. Proposed settling tanks, beds and filters. 1904, ii-430.

Slow sand filtration:

Covers for slow sand filters. From a Report to the Trenton Water Board, N. J. By Allen Hazen, 1901, i-58, 64.

Formulas and diagrams relating to the economical dimensions of rectangular filter beds. By J. H. Gregory, Jr., 1900, ii-252.

Slow sand filtration vs. ozone treatment. Discussion of paper by Dr. Weyl before German Society of Gas and Water-Works Engineers. 1900, i-92, 96, 130.

(See also Albany, N. Y.; Altona, Ger.; Berlin, Ger.; Boston; Far Rockaway; Lawrence, Mass.; London; Marlborough, Mass.; Mt. Vernon, N. Y.; Pittsburg, Pa.; Providence, R. I.; Springfield, Mass.; Superior, Wis.; Washington, D. C.)

Softening water. (See Water softening.)

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Water purification: (Continued.)

Springfield, Mass. Slow sand filtration experiments. Tastes and odors in Ludlow storage reservoir. 1901, i-17; 1902, i-301; 1903, ii-280.

Strawboard wastes, Investigation of. 1903, i-488.

Subsidence. (See Bartlesville, I. T.; Denver, Colo.; Kansas City, Mo.; Louisville, Ky.; Norfolk, Va.; Pittsburg, Pa.; Philadelphia, Pa.; St. Louis, Mo.; Vincennes, Ind.; Washington, D. C.)

Superior, Wis. Removal of iron. Covered filter beds, aerator and clear water reservoir. Pumping station. Costs. By R. D. Chase, 1901, i-*141.

Toledo, Ohio. Mechanical filter plant recommended. 1903, i-76.

United States. Table showing location of plants, ownership and kind of purification. 1902, i-310.

Upward filtration, Bartlesville, I. T. Coagulation and sedimentation. 1904, ii-*212.

Vincennes, Ind. Mechanical filtration plant combining coagulation, subsidence and filtration. 1900, i-*291.

Wakefield, England. Treatment of moorland water to prevent action upon lead pipes. Experiments with carbonate of soda, chalk and lime. By C. C. Smith and E. M. Chaplin, 1904, i-*598.

Washington, D. C.:

Experiments. Reports by Col. Miller, E. D. Hardy and R. S. Weston. Coagulation, subsidence, slow sand and mechanical filtration. 1900, i-315, 324.

Report of experts Rudolph Hering, G. W. Fuller and Allen Hazen, made Feb. 18, 1901. Site of plant. Estimated cost. 1901, i-1, 152, 159, 329, 345.

Wiesbaden, Germany. Treatment of water by ozone. 1904, i-535.

Wilmington, Del.:

Filtration plant closed. 1903, ii-142.

Litigation over contract between city and United States Sand Filtration Co. Text of contract; its objectionable features. 1903, ii-474, 479, 501.

Winchester, Ky. Aerator for mechanical filter plant. By Leonard Metcalf, 1901, i-*410.

Youngstown, Ohio. Purification plant recommended. 1903, ii-304.

Zurich, Switzerland. Effect of new filter plant on prevalence of typhoid fever. By K. & R. Tanner, 1904, i-402.

Water rates:

Automatic sprinkler systems, Rates for. By A. W. Hardy, 1902, ii-259, 266.

Baltimore, Md. Special meter schedule proposed for charitable, religious and educational institutions. 1901, ii-426, 428.

Burlington, Vt. 1902, i-425.

Detroit, Mich. Supreme Court decision. 1900, i-17.

Discussion at American Water-Works Association. 1903, ii-17.

Fargo, N. D. "Free water" advocated by Mayor J. A. Johnson. 1901, ii-330.

Fire protection service for mill property and other large buildings. Discussion at New England Water-Works Association. 1901, ii-120.

Fixed and sliding-scale charges. 1904, i-568.

Ithaca, N. Y. Propositions of private company. Report by Finance Committee of Common Council. 1900, i-192.

Knoxville, Tenn. Municipal regulation of rates upheld by Court. 1901, ii-369.

Meter schedules which encourage water waste. 1903, ii-269.

New England. Permanent and surplus supply. 1900, i-49.

San Antonio, Texas. Report on rates and valuation by Chester B. Davis. 1902, ii-233.

San Francisco, Cal. Controversy. 1903, ii-78.

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Street sprinkling. Various methods of computing value of water. 1902, ii-259.

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Water registers:

Friez, Installation of. By C. T. Johnston, 1901, ii-*134.

Gurley, Installation of. By C. T. Johnston, 1901, ii-131.

Installing registers, Instructions for. United States Department of Agriculture. By C. T. Johnston, 1901, ii-*132.

Leitz, installation of. By C. T. Johnston, 1901, ii-*134.

Mead continuous automatic, giving record of water levels on a natural scale. Irrigation investigations by Elwood Mead, 1901, i-139; By C. T. Johnston, 1901, ii-*133.

Standard registers, Installation of. By C. T. Johnston, 1901, ii-*134.

Water resistances in testing combined engine-generator sets. 1904, i-303.

Water rights:

Interstate stream, Legal decision concerning. Byram River rises in New York and flows into Connecticut. 1902, i-301, 310.

Kansas-Colorado controversy. 1904, ii-503.

Riparian rights to the water of streams crossing international boundaries. Rio Grande and Colorado Rivers. 1904, i-448.

Water sample trap for use in silt investigations. 1902, ii-*208.

Watershed, Improper use of word. 1903, ii-Eng. Lit. Sup., Sept. 17.

(See also Drainage areas.)

Water softening:

Art and chemistry of water softening. Economy in large size plants. By J. O. Handy, L. M. Booth, 1904, i-492, *500, 516, 542.

Burt continuous water-softening process. 1904, ii-238.

Four systems of water softening. Plant for the Tennessee Coal, Iron & Ry. Co., at Ensley, Ala. New York-Continental-Jewel system for the Columbia Chemical Co., Babberton, Ohio. Breda apparatus at factory of Wm. Demuth & Co., Brooklyn, N. Y. Tweeddale system at railway shops in Topeka, Kan. 1903, ii-*4.

Inquiry into the working of various water softeners. By C. E. Stromeyer, 1904, i-530.

Iowa well waters. Investigations at Cornell College by C. G. Eldredge. Effect of boiling. Effect of lime water. By Nicholas Knight, 1904, ii-148, 151, 199, 314.

Kennicott system. Treatment of Lake Michigan water. Plant at Point of Rocks, Wyoming, on the Union Pacific Ry. 1902, i-*386.

Lorain Steel Co. Details of plant. By N. O. Goldsmith, 1900, i-335.

Middlepoint, Ohio, plant. By J. O. Handy, 1904, i-*501.

Oberlin, Ohio. Plans for plant. 1903, ii-113.

Procter & Gamble Co.'s plant, Ivorydale, Ohio. 1904, i-*94.

Softening of water for locomotives. Report at American Railway Engineering and Maintenance of Way Association. 1904, i-264.

Softening water for Western railways. 1904, i-22.

Southampton, England. Municipal plant. By J. O. Handy, 1904, i-505.

Winnipeg, Manitoba. Municipal plant. By J. O. Handy, 1904, i-*505.

Waterspouts. (See Rainfall, North Carolina.)

Water stations. (See Railway water stations.)

Water storage in New York State. Report of commission on flood prevention and water storage. 1903, i-115, 183, 381.

Water supply:

Albion, N. Y. Quality of the underground water as affected by infiltrated canal water. Condemned by Engineer of State Board of Health. By G. C. Mills, 1904, i-180, 303.

Algae in water supply. (See Water purification, Copper sulphate treatment.)

"1900, ii-112" means "Year, 1900, second volume, page 112."

Water supply: (Continued.)

Baltimore, Md. Sanitary protection. Regular inspection of water supplies. Extract from the Maryland Statutes. Rules of State Board of Health. By A. M. Quick, 1901, ii-431.

Brooklyn, N. Y.:

Damages for diversion of underground water. 1901, ii-33.

Famine scare. 1900, ii-60, 387.

Fire service. Report on high pressure service. By I. M. de Varona, 1904, i-288.

Litigation. Case of Benj. F. Forbell vs. the City of New York. Decision of New York Court of Appeals in favor of Forbell. Rights in underground water. Engineering testimony. By De Varona, Ward and Hering, 1900, ii-385, 388.

Litigation, underground cases. 1901, i-358.

Report for 1903. 1903, ii-602.

Underground water supply, Proposed development of. By I. M. de Varona, 1902, ii-*304, 317, 325.

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Fire protection. Proposed high pressure system. Report by G. W. Jackson. 1904, i-*197.

Improvement of supply. 1904, ii-197, 270.

Impurity of water. No drinking water in schools. 1902, ii-137, 349, 474.

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Columbus, Ohio. Notes on the Scioto River supply and the pumping stations. Typhoid fever epidemic. By F. H. Eno, 1904, i-129, 134.

Cost of water, metered supplies and water waste. By A. L. Holmes, 1902, i-109.

Crenothrix. (See Water pipe, Crenothrix.)

Crookston, Minn. Proposed artesian wells and abandonment of filter gallery. 1902, ii-25.

Dayton, Ohio. Well system. By C. E. Rowe, 1901, ii-296.

Fire service. (See Fire protection.)

Forests, Relation to supply. New Jersey. By C. C. Vermeule, 1900, ii-58.

Frankfort-on-the-Main. 1904, i-534.

Gibraltar. Proposed new supply. By W. P. Mason, 1901, i-*458.

Iron in water. (See Water purification, Iron.)

Ithaca, N. Y. (See Typhoid fever, Ithaca, N. Y.)

Johnstown, Pa. Purchase of land for protection of supply. 1900, ii-397.

Manila, P. I. 1903, ii-57.

Mexico, City of. History of supply. 1900, i-249.

Middletown, Ohio. New well sunk for additional supply. 1904, ii-122.

Minneapolis, Minn. Foul condition of water supply. 1901, ii-330.

New Orleans. New supply proposed by Morill & Cragin. 1900, ii-117.

New York:

Ramapo Water Co. Legislature repeals act of 1895 which gave company special privileges. 1900, i-153, 194, 227; 1901, i-208.

Long Island Water Supply Co. purchased. 1900, i-249.

Report of J. R. Freeman. Water consumption and waste. Future water requirements of Greater New York. Tables and diagrams. 1900, i-256, 260; 1900, ii-129.

Reports of Merchants' Association on water waste and future supply of Greater New York. 1900, ii-129, 135.

Movement for an additional supply. Commission of engineers suggested. 1902, ii-292.

Reducing water waste, Need of. 1902, ii-448.

Tree cutting in the Croton drainage area. 1903, i-25.

"Proposed" supply from northern lakes. 1903, i-234.

Report on additional supply. Burr, Hering and Freeman Commission. 1903, ii-280, 293, 297, 566, 572.

* denotes an illustrated article. † denotes an inset sheet.

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New York: (Continued.)

- Need of additional supply. Excerpt from J. R. Freeman's report. 1904, ii-42.
- Letter of civic organizations to Mayor McClellan. 1904, ii-89.
- Preliminary report on an additional supply by Birdsall. Question referred to Burr-Hering-Freeman Commission. 1904, ii-312, 528.
- Dutchess County streams, Bill in Legislature concerning. 1904, i-423, 467.
- Danger of a famine. From report made by J. W. Smith to New York Aqueduct Commission. 1904, ii-538.
- Report on filtering the Croton water supply by Smith, Hazen and Whipple. 1904, ii-573.
- New York State. State commission proposed. Bill in Legislature, 1904, i-80.
- Newark, N. J. Ownership and control of water rights and reservoirs in Pequannock drainage area transferred by East Jersey Water Co. 1900, ii-221.
- North Carolina. Protection of supply. Act passed by Legislature. 1903, i-337.
- Norwich, Conn. Compensating mill owners for diverted water by supplying them with stored water in time of drouths. Report of engineers. By Hill, Quick and Allen, 1901, i-381.
- Ohio. Investigation of public water supplies from Ohio River and Lake Erie by State Board of Health. 1901, ii-63.
- Paris. Sources and amount of supply. Water famine, water waste and purification. Comparative merits of spring and filtered water. By Adolph Kemna, 1900, ii-72, 274, 281; 1901, i-*247.
- Pittsburg, Allegheny and vicinity. Typhoid fever history. 1904, i-176, 185.
- Pressure, Value of. New York City. Ramapo Water Co. 1900, i-153, 194, 227.
- Protection of supplies:
 - Baltimore, Md. Regular inspection. Extract from Maryland Statutes. Rules of State Board of Health. By A. M. Quick, 1901, ii-431.
 - England. Protection of supplies. By J. Cartwright, 1904, i-401, 408.
 - Ohio. Protection by supervision of State Board of Health. 1904, ii-430, (See also Water pollutions.)
 - St. Louis, Mo. Reports by expert Commission of Williams, Wisner and Hazen. Communication from G. W. Fuller. 1902, i-196.
 - Salt Lake City, Utah. Electrically-driven centrifugal pumps to supplement water supply. 1902, ii-249.
 - Santa Barbara, Cal. Proposed tunnel. 1904, i-148.
 - Satisfactory supply, What constitutes? Report at American Public Health Association. 1900, ii-285.
 - Softening water. (See Water softening.)
 - Swamp drainage for the improvement of public water supplies. 1901, ii-477.
 - Tapping a lake in France 60 feet below the water surface. 1901, i-117.
 - Tastes and odors. (See Water.)
 - Tipton, Ind. Well system. Lifting water with compressed air. By John Langan, 1901, ii-296.
 - Troy, N. Y. Development of supplies on the Tomhannock and Quackenkill Rivers. By W. G. Raymond, 1904, ii-*300.
 - Typhoid fever and water supply. (See Typhoid fever.)
- Underground:
 - Artificial underground supply at Gothenburg, Sweden. System developed by Gustaf Richert. 1903, i-*32, 35, 237.
 - California. Legal decisions. Rights in percolating underground waters. 1902, ii-477; 1904, i-42.
 - English law in regard to underground water. By J. S. Will, 1900, ii-383, 388; 1901, i-430.

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Water supply:

Underground: (Continued.)

Geologic principles of subterranean water supply. By F. J. H. Merrill, 1904, ii-361.

Geologists' report on artesian supply for Waterloo, Iowa. "Water diviner's" work at Manchester, England. 1904, ii-111.

Mississippi. Legal decision. 1902, i-241.

Progressive sinking of the ground water level and artificial ground water supplies. By J. G. Richert, 1904, ii-*474.

Underground waters adjacent to surface streams, Possible use of. By C. G. Hubbel, M. O. Leighton, 1904, i-409, 518.

Velocity of Slichter's electrical method of determining. By C. S. Slichter, 1902, i-*151.

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Washington, D. C. Use of wells. 1900, ii-371.

Waterloo, Iowa. Underground supply or slow sand filtration plant? Report on underground supply. 1904, i-448; 1904, ii-111.

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Water tanks:

Abilene, Texas. Failure. By S. F. Moeller, 1904, i-468, *475, 517.

Ancient tanks of Aden, Arabia. By A. S. Riggs, 1904, ii-*25.

Antwerp Iron & Steel Works. Elevated tank. 1902, ii-*321.

Cedar Falls, Iowa. Failure of elevated wooden tank. 1900, ii-374, 387, 447.

Combined tank and coal box for locomotives, Vanderbilt invention. 1901, ii-407.

Curved bottoms. Junction details for sides and bottoms of elevated steel tanks. By A. Marston, 1902, i-*11.

East Providence, R. I. New tank and supporting tower. By F. M. Bowman, 1904, ii-*413.

Fairhaven, Mass.:

Failure on Nov. 9, 1901. By John Galt, A. Marston, 1901, ii-357, *392, *433; By Edward Godfrey, Leopold Mensch, 1902, i-*11.

New 500,000-gallon elevated tank proposed. 1902, i-17.

Frankfort, Ind. Failure. 1902, ii-473.

Hattiesburg, Miss. Failure of wood stave tank, Jan. 24, 1903. 1903, i-117.

Hoisting water in the Pennsylvania anthracite region. By R. V. Norris, 1903, i-*315.

Lacona, N. Y. Storage tanks under air pressure. Babylon, N. Y. Southampton, N. Y. 1900, i-105.

Lead, S. D. Failure. 1902, ii-325.

Lincoln, Mifflin Township, Pa. Failure. 1903, i-225.

Madison, Neb. Failure of elevated wooden tank. By A. C. Koenig, 1902, ii-*526; 1903, i-13.

Parkersburg, W. Va. Corroded plates cause failure of several sheets. 1902, i-61.

Paterson, N. J., Bamford Bros. silk mills. Failure of wooden tank by rusting of hoops from inside. By J. R. Freeman, W. E. Stanley, 1900, ii-*446.

Philadelphia, Dobson's mills. Failure of cedar tank. 1902, ii-349.

Providence, R. I. N. Y., N. H. & H. R. R. Failure of wooden tank. 1902, ii-489.

Provincetown, Mass. N. Y., N. H. & H. R. R. Failure. 1902, ii-281, 325.

Sandusky, Ohio. Failure of wooden tank, Oct. 15, 1904. 1904, ii-386, 421, 503.

Sheffield, Ala. Failure. 1902, i-425, 449.

Tiffin, Ohio. Failure. 1904, ii-134.

Vermillion, S. D. Failure. 1902, i-181.

Waltham, Mass. Failure. 1904, ii-488, 503.

Washington Heights, Chicago. Elevated tank with hemispherical bottom. 1902, ii-*544.

* denotes an illustrated article. † denotes an inset sheet.

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Wooden:

- Failure and repair of the bottom of a wood stave tank. By J. L. Gray, 1903, i-175.
- Stress diagram for water tank hoops. By M. S. Pope, Ballinger & Perrot, 1903, i-318, 349.
- Suggestions for an elevated wooden tank. By G. W. Pearsons. 1901, i-*210.

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Water telescopes, Buffalo, N. Y., breakwater construction. 1901, i-*347.

Water towers:

- Concrete-steel, Fort Revere, Hull, Mass. 1904, ii-596.
- Fire department tower, raised by Pelton water wheel. 1902, i-381.
- Quincy, Mass. Masonry tower enclosing standpipe. By C. M. Saville, 1902, i-220.
- Wilmington, Del. Rockford water tower. Steel and concrete roof. 1902, i-*166.

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Water waste:

Boston. Investigation of waste and leakage. 1903, i-13, 234.

Chicago:

- Report by John Ericson on water waste and the metering of the water supply, made Nov. 13, 1902. 1903, i-41, 488.
- Investigations of water waste by means of the Cole-Flad pitometer, under the direction of E. S. Cole. 1904, ii-538.
- Cleveland, Ohio. Methods of checking waste. 1903, ii-347.
- Columbus, Ohio. 1902, ii-225.
- Discussion at American Water-Works Association. 1903, ii-16, 17.
- Europe. Report of New York Merchants' Association by C. O. Johnson. 1903, i-301, 311.
- Great Britain, Prevention in. 1904, i-622.
- Hartford, Conn. Inspection of fixtures. 1900, i-144.
- Jersey City, N. J. Influence of cold weather. 1900, i-144, 153.
- Lawn sprinkling, Violations of. Regulations in Boston. 1903, ii-12.
- Massachusetts. Relation between quantity of water passed through meters and total quantity of water pumped in 1900. 1902, ii-414, 450, 476.

New York City:

- Report of J. R. Freeman. Water consumption and waste. Future water requirements of Greater New York. Tables and diagrams. 1900, i-256, 260.
- Engineer Commission gives City Club a hearing. 1903, i-12.
- Investigation by Water Department by means of Cole-Flad pitometer. Second progress report by N. S. Hill, Jr. Summary of results to March, 1903. 1903, i-135, 335.
- Report of Merchants' Association on waste prevention in Europe, by C. O. Johnson. 1903, i-301, 311.
- Report by N. S. Hill, Jr., addressed to R. G. Monroe. 1903, ii-277.
- Norfolk, Va., City council votes to meter each end of 24-inch force main. 1901, ii-72.
- Philadelphia, Pa. Proposed repeal of hopper water-closet restrictive ordinance. 1900, ii-332.
- Saratoga Springs, N. Y. Relation to sewage purification. Use of meters 1900, i-144, 176.
- Springfield, Mass. Clemens Herschel advises use of meters. 1900, i-128.
- Syracuse, N. Y. Use and waste by public schools. 1903, ii-238, 245.
- Washington, D. C. Bearing of water waste upon water purification and upon municipal financiering in general. 1901, ii-348.

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Water-wheel governor, Replogle "differential relay." 1902, ii-*409.

Water-wheel meter, Rockwood & Allen. 1902, ii-510.

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Breast wheels, German designs of. Wheel for large flow. Wheel with guide vanes. 1902, ii-*436.

Chinese wheels. By L. F. Bellinger, 1902, i-*494.

Current water wheels used on the Snake River, Idaho. By Ernest McCulloch, 1903, i-36.

De Remer "tangential impact" wheel. Comparison with Pelton wheel. Tests by R. C. Carpenter. 1901, ii-*450, 492.

Design of buckets for impulse wheels. Experiments by G. J. Henry, Jr. 1903, ii-*322.

Driving from steam pumps. 1900, i-114.

Efficiency curves using two-inch nozzle, bronze and steel needles. By G. J. Henry, Jr., J. N. Le Conte, 1903, ii-*312.

Experiments and formula for the efficiency of tangential water wheels. By B. F. Groat, 1904, ii-430.

Governor, Lombard, controlling two water wheel units, Manchester, Conn. By E. E. Boardway, 1903, i-*249.

Governing impulse water wheel by an induction motor, Bay Counties Power Co., Cal. 1903, i-246.

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Largest single-stream wheel ever built. 1903, ii-402.

Redlands, Cal. Impulse wheel under high head. By G. J. Henry, Jr., L. M. Hoskins, 1903, ii-121, 247, 297, 318.

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Largest overshot wheel in existence, Isle of Man. 1903, i-421.

Pelton steam driven water motor. 1903, i-245.

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Water-works:

Aden, Arabia. Ancient water-tanks. By A. S. Riggs, 1904, ii-*25.

Appraisal. (See Appraisal of water works plants.)

Boston:

Method of locating pipe connections and gates. By F. I. Winslow, 1903, i-*556.

Metropolitan Water and Sewerage Board of Boston and vicinity. 1901, i-129, 217.

Weston aqueduct. 1901, i-*360.

Brooklyn, N. Y., Mt. Prospect laboratory. By G. C. Whipple, 1900, i-376, *381.

Canton, Ill. 1902, i-97.

Capacity required. Recommendations by S. E. Babcock. 1903, ii-16.

Cincinnati, Ohio:

Progress on new works. 1900, i-†270.

Intake and eastern pumping station. Purification plant. Land tunnel. Engineers. Contractors. 1901, i-371.

Intake caisson. Breaks in the masonry lining of shaft. 1901, i-*389.

Controversy with the contractor, A. J. Henkel. 1901, ii-281.

Notes on new works. 1902, i-469.

Cleveland, Ohio:

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Superintendent M. W. Kingsley. Statement concerning his dismissal. 1901, ii-327.

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Danville, Ill. Concrete dam. Filter plant. Pumping engine, 1904, i-*395.

Denver, Colo. Municipal ownership. Injunction against issue of bonds. 1901, i-113, 385.

Elberton, Ga. Small plant, uncompleted. 1901, i-119.

Evansville, Ind. Repair of the pumping station. 1904, i-250.

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* denotes an illustrated article. † denotes an inset sheet.

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- Gloucester, Mass. City condemns and appropriates property of water company. 1902, ii-1.
- Griffin Mines, Ogden, Va. Water supply for iron mines. By J. N. Ambler, 1901, ii-*110.
- Hensonville, N. Y. By E. W. Moxley, 1904, i-344.
- Illinois. Report of Committee of Illinois Society of Engineers and Surveyors. 1903, i-101.
- Inspection of water services and fixtures. 1903, ii-17.
- Intakes. (See Tunnels, Water-works.)
- Jersey City, N. J. Notes on water supply contract. 1902, i-205, 285, 301.
- London, England. Municipal ownership. Parliamentary act. Sale of private works on June 23, 1904. 1903, i-441; 1904, ii-41, 473.
- Los Angeles, Cal. Municipal ownership assured. 1901, ii-81, 185.
- Maine. Movement for municipal ownership. 1903, i-477.
- Maine Water Co., Appraisal of. 1903, ii-442.
- Manchester, England. Regulations as to interior water fittings. 1904, i-*623.
- Manila, P. I. Bond issue for improvements. 1904, ii-182.
- Memphis, Tenn. Investigation of water supply problem. 1902, ii-41, 96.
- Menominee, Mich. Suit between municipal authorities and Menominee Water Co., involving franchise rights of company. Supreme Court decision in favor of company. 1900, ii-234.
- Mobile, Ala. Appraisal of works. Report of Board. 1903, i-368, 359, 411.
- Monterey, Mexico. Proposed water-works and sewerage works. By E. S. Gould, 1904, ii-*385.
- Montreal, Canada. Historical notes. Service boxes. 1903, ii-237.
- Moving plant from Greensburg, Kan., to Alva, Oklahoma Territory. 1900, i-153, 175.
- Nashua, N. H., Pennichuck water-works pumping plant. By F. W. Dean, 1901, i-†410.
- New Orleans. Advisory board and its recommendations. 1900, i-401.
- New Orleans Water-Works Co. Liquidator appointed. 1902, ii-373.
- Omaha, Neb. Vote for municipal ownership. 1900, i-185.
- Pearl River Lumber Co., Brookhaven, Miss. Well-arranged plant for protection against fire and for supplying water for various purposes. 6-inch tubular well, 450 feet deep. Costs. By W. C. Porter, 1901, i-33.
- Peoria, Ill. Auxiliary hydraulic pumping plant. Tests and operation. By D. H. Maury, Jr., 1900, i-*268.
- Philadelphia, Pa.:
- Failure of \$9,000,000 water loan. 1901, ii-8.
 - Center Square pumping station operated from 1801 to 1815. 1903, i-*422.
 - Instructions to inspectors of cast-iron water pipe, special castings and stop valves. 1903, i-527.
- Pratt City, Ala. Small water-works system. Supply drawn from wells. 1901, i-119.
- Private fire services. (See Fire protection.)
- Quincy, Ill. Appraisal of private water-works. 1904, ii-22.
- St. Louis, Mo. Changes in settling basins and the hydraulic dredge for cleaning basins. By E. E. Wall, 1903, ii-*484.
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- San Francisco, Cal. Municipal ownership. Bids asked. 1900, i-281; 1900, ii-69, 232.
- Trotwood, Ohio. Small plant with storage under compressed air. Supply from driven wells. By B. H. Flynn, 1901, i-213.
- Troy, N. Y.:
- Plans for new works. 1902, i-101.
 - Development of new supplies from Tomhannock and Quackenkill Rivers. By W. G. Raymond, 1904, ii-*300.
- "1900, ii—112" means "Year, 1900, second volume, page 112."

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Tullahoma, Tenn. Small municipal water and electric light plant. 1903, i-536.

Valparaiso, Ind. Appraisal case decided in favor of city. 1903, i-289.

Warren, Ohio. Reconstruction of water and electric lighting station. 1901, ii-*146.

Warrington, England. Extensions. 1904, i-596.

West Australia. Coolgardie pipe line. 1903, i-289.

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Wattmeter, Electrostatic, in commercial measurements. By Miles Walker, 1902, ii-5.

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Conservation of the flow from artesian well basins. Suggestions by Prof. I. C. Russell. 1903, i-476.

Memphis, Tenn. Early studies of the well system by John Lundie. Report of engineering commission, Hilder, Omberg, Jr., and Bell. 1902, ii-*245, 248.

Compressed air plant, for lifting water, Tipton, Ind. By John Langan, 1901, ii-296.

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 Trotwood, Ohio. Town water supply. Storage under compressed air. By B. H. Flynn, 1901, i-213.
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 Far Rockaway, N. Y. Removal of iron in water by slow sand filtration. 1900, i-238.
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 Middletown, Ohio. Open wells. Suction pipes placed inside strainer pipes. 1904, ii-*122.
 Open wells and turbine pumps. Self-contained gravel strainer designed by D. H. Maury. Corrosion of deep-well fixtures. By D. H. Maury, 1904, ii-*138, 151.
 "Stove-pipe" method of well construction in Southern California. By C. S. Slichter, 1903, ii-*429.
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